



MOTOROLA

MOCOM-70

Mobile FM Two-Way Radio

450-470 MHz

25 W RF Power

And

470-512 MHz

10,25,&50 W ERP





CUSTOMER QUESTIONNAIRE

To the Reader of This Instruction Manual:

Motorola is engaged in a continuous program of improving its instruction literature. We believe that you can aid us in this program, so that we in turn can better help you service our equipment. To foster these aims, would you please answer the following questions:

SCHEMATIC DIAGRAMS AND CABLING DIAGRAMS

1. ☐ Are accurate and easy to follow
2. ☐ Contain minor errors
3. ☐ Contain major errors
4. ☐ Are difficult to follow

If you have checked any box except 1, please tell us what schematic diagrams, or portions thereof, were at fault, or enter other comments.*

TEXT

1. ☐ Easy to follow — helps to service equipment
2. ☐ Would like more information on*

3. ☐ Some instruction sections are too long or superfluous such as*

4. ☐ Other comments*

(continued on reverse side)

68P85901D80-F

PARTS LIST

1. ☐ Are complete and accurate
2. ☐ Would like more information as follows*

ILLUSTRATIONS IN GENERAL

1. ☐ Are complete and accurate
2. ☐ Want more illustrations such as*

3. ☐ Some are superfluous such as*

The name of my instruction manual is:

The part number of my instruction manual is:

(This number will be found on the cover or on the title page)

My name is _____

Company _____

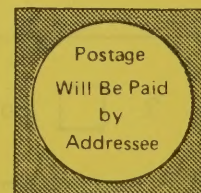
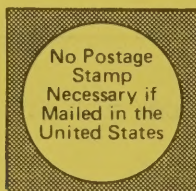
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*Whenever possible, give complete model No. of equipment, and part No. of diagram or part No. of instruction section. This information is important.



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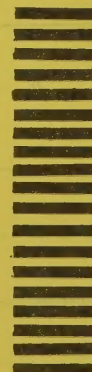
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ENGINEERING PUBLICATIONS DEPT.

MOTOROLA, INC.

1301 E. Algonquin Road

Schaumburg, Illinois 60172



MOTOROLA

"MOCOM • 70"

MOBILE FM TWO-WAY RADIO

450-470 MHz

25 W RF POWER

AND

470-512 MHz

10/25/50 W E.R.P.



MOTOROLA INC.

ENGINEERING PUBLICATIONS

1301 E. ALGONQUIN ROAD

Communications Division

SCHAUMBURG, ILLINOIS 60172

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68P81011E30
Issue - D

SPECIFICATIONS

GENERAL

| | | |
|--|--|-------------------------|
| MAXIMUM BATTERY DRAIN* | RECEIVE (STANDBY) | 13.8 V dc 450 mA |
| | TRANSMIT | 13.6 V dc 14 Amperes |
| *Drain figures for negative ground only, add .080 amp for positive ground operation. | | |
| FREQUENCY RANGE | 450-512 MHz | |
| METERING | A single scale, 0-50 microampere meter with 20,000 ohms equivalent series resistance or Motorola portable test set can be used to measure all circuits essential to tuning and checking. | |
| DIMENSIONS | 4" high x 10-3/4" wide x 16-1/2" long | |
| WEIGHT | Approximately 25 lbs (shipping weight including accessories: approximately 50 lbs). | |

| | | |
|-------------------------------|--|-------------------|
| TRANSMITTER | 450-470 MHz | 470-512 MHz |
| RF POWER OUTPUT | 25 watts | 10/25/50 W E.R.P. |
| OUTPUT IMPEDANCE | 50 ohms | |
| SPURIOUS & HARMONIC EMISSIONS | Spurious and harmonics more than 60 dB below carrier (per EIA spec RS-152B, Par. 4 and 5. | |
| FREQUENCY STABILITY | A temperature compensated quartz crystal maintains oscillator frequency within $\pm .0005\%$ of reference frequency from -30°C to $+60^{\circ}\text{C}$ ambient ($+25^{\circ}\text{C}$ reference) and $\pm .0005\%$ with a 20% primary voltage deviation. | |
| MODULATION | 16F3: ± 5 kHz for 100% at 1000 Hz @450-512 MHz | |
| AUDIO SENSITIVITY | 0.1 volt ± 3 dB for 3.0 kHz deviation at 1000 Hz | |
| FM NOISE | -70 dB below ± 3.0 kHz deviation at 1000 Hz | |
| AUDIO RESPONSE | +1, -3 dB of 6 dB/octave pre-emphasis characteristic from 300 to 3000 Hz | |
| AUDIO DISTORTION | Less than 3% at 1000 Hz for ± 3.0 kHz deviation | |

| | | |
|----------------------------|--|---|
| RECEIVER | | |
| CHANNEL SPACING | 25 kHz | |
| SELECTIVITY (EIA SINAD) | -90 dB at 25 kHz, 450-470 MHz | -88 dB at 25 kHz, 470-512 MHz |
| EIA SINAD INTERMODULATION | -80 dB at 25 kHz (-75 dB with preamplifier) | |
| EIA MODULATION ACCEPTANCE | ± 7.0 kHz minimum | |
| SENSITIVITY | 20 dB QUIETING | Less than 0.5 microvolt (less than 0.25 microvolt with preamplifier) |
| | EIA SINAD | Less than 0.35 microvolt (less than 0.18 microvolt with preamplifier) |
| FREQUENCY STABILITY | A temperature compensated quartz crystal maintains oscillator frequency within $\pm .0005\%$ of reference frequency from -30°C to $+60^{\circ}\text{C}$ ambient ($+25^{\circ}\text{C}$ reference) and $\pm .0005\%$ with a 20% primary voltage deviation. | |
| SPURIOUS & IMAGE REJECTION | More than 100 dB | |
| SQUELCH | Carrier squelch; noise compensated type, adjustable sensitivity, threshold sensitivity of 0.25 microvolt. "Private-Line" tone-coded squelch; also includes a tone-operated squelch circuit, adjustable sensitivity, threshold sensitivity of 0.25 microvolt. (Squelch threshold sensitivities are 0.15 microvolt with pre-amplifier) | |
| AUDIO OUTPUT | 5 watts to a 3.2-ohm load measured at the receiver output at less than 5% distortion @ 1000 Hz | |
| AUDIO RESPONSE | +2, -8 dB of 6 dB/ octave de-emphasis characteristic from 300 to 3000 Hz | |

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

FCC LICENSE DESIGNATIONS

| Frequency Range | Single Frequency | Multiple Frequency |
|-----------------|------------------|--------------------|
| 450-470 MHz | CC4111 | CC4112 |
| 470-494 MHz | CC4128-1 | CC4129-1 |
| 494-512 MHz | CC4128-2 | CC4129-2 |

FCC RECEIVER DESIGNATIONS

| Frequency Capability | Standard | With Preamplifier |
|------------------------|----------|-------------------|
| Single | RC0057 | RC0058 |
| Multiple (2-4 & T2-R1) | RC0059 | RC0060 |
| Eight | RC0061 | Not Available |

EPS-18788-O

FOREWORD

1. SCOPE OF MANUAL

This manual is intended for use by experienced technicians familiar with similar types of equipment. It contains all service information required for the equipment described and is current as of the printing date. Changes which occur after the printing date are incorporated by Instruction Manual Revisions (SMR). These SMR's are added to the manuals as the engineering changes are incorporated into the equipment.

2. MODEL AND KIT IDENTIFICATION

Motorola equipments are specifically identified by an overall model number on the nameplate. In most cases, assemblies and kits which make up the equipment also have kit model numbers stamped on them. When a production or engineering change is incorporated, revision suffix numerals are added to the affected kit model number. For example, a TLN4448A becomes a TLN4448A-1 with the first revision, TLN4448A-2 with the second revision, etc.

As diagrams are updated, information about the change is incorporated into a revision column. This revision column appears in the manual up issue next to the parts list or, in some cases, on the diagram. It lists the reference number, part number, and description of the parts removed or replaced when the suffix number changed. With this information, the technician can find the information for the current version, and any previous version, of the equipment covered by the manual.

3. SERVICE

Motorola's National Service Organization offers the finest nationwide installation and maintenance program available. The organization includes over 800 strategically-located Motorola Service Stations (MSS) each having a trained staff of FCC-licensed technicians.

These MSS's are independently owned and operated, and franchised by Motorola to service their customers. Such service may be purchased as required, or may be contracted for on a calendar-period basis.

The administrative forces of area and district service managers, and district service representatives, are in the direct employ of Motorola.

Should you wish to purchase a service contract for your Motorola equipment, contact your Motorola Service Representative, or write to:

National Service Manager
Motorola Communications Division
1301 E. Algonquin Road
Schaumburg, Ill. 60172

4. REPLACEMENT PARTS ORDERING

Motorola maintains a number of parts offices strategically-located throughout the United States. These facilities are staffed to process parts orders, identify part numbers, and otherwise assist in the maintenance and repair of Motorola Communications Division products.

Orders for all parts except crystals, channel elements, and "Vibrasender"® and "Vibrasponder"® resonant reeds should be sent to the nearest area parts center. Orders for instruction manuals should also be sent to the area parts and service center.

When ordering replacement parts or equipment information, the complete identification number should be included. This applies to all components, kits, and chassis. If the component part number is not known, the order should include the number of the chassis or kit of which it is a part, and sufficient description of the desired component to identify it.

Orders for crystals, channel elements, active filters, code plugs, and reeds should be sent directly to the factory address listed below. Crystal and channel element orders should specify the crystal or channel element type number, crystal and carrier frequency, and the chassis model number in which the part is used.

Orders for active filters, code plugs, "Vibrasender" and "Vibrasponder" resonant reeds should specify type number and frequency, and should identify the owner/operator of the communications system in which these items are to be used.

68P81025E81- B

5. ADDRESSES

5.1 GENERAL OFFICES

MOTOROLA INC.
Communications Division Parts Dept.
1313 E. Algonquin Rd.,
Schaumburg, Illinois 60172
Phone: 312-397-1000
Executive Offices: 1301 E. Algonquin Rd.,
Schaumburg, Illinois 60172

5.2 U.S. ORDERS

WESTERN AREA PARTS

1170 Chess Drive, Foster City,
San Mateo, California 94404
Phone: 415-349-3111
TWX: 910-375-3877

MIDWEST AREA PARTS

10 N. North Ave.,
Lombard, Ill. 60148
Phone: 312-620-3000
TWX: 910-693-1592

MID-ATLANTIC AREA PARTS

6701 Elkridge Landing Road,
Linthicum, Maryland 21090
Phone: 301-796-8600

EAST CENTRAL AREA PARTS

12995 Snow Road,
Parma, Ohio 44130
Phone: 216-267-2210
TWX: 810-421-8845

EASTERN AREA PARTS

85 Harristown Road,
Glen Rock, New Jersey 07452
Phone: 201-447-4000
TWX: 710-988-5602

PACIFIC SOUTHWESTERN AREA PARTS

2333 Utah Avenue,
El Segundo, California 90245
Phone: 213-644-1101
TWX: 910-348-6278

SOUTHWESTERN AREA PARTS

3320 Belt Line Road,
Dallas, Texas 75234
Phone: 214-241-2151
TWX: 910-860-5505

SOUTHEASTERN AREA PARTS

5096 Panola
Industrial Blvd.
Decatur, Georgia 30032
Phone: 504-981-9800
TWX: 810-751-8300

5.3

CANADIAN ORDERS

CANADIAN MOTOROLA ELECTRONICS COMPANY

Parts Department
3125 Steeles Avenue,
East Willowdale, Ontario
Phone: 516-499-1441.
TWX: 610-492-2713
Telex: 02-29944LD

5.4

ALL COUNTRIES EXCEPT U.S. AND CANADA

MOTOROLA, INC. OR MOTOROLA AMERICAS, INC.

International Parts
1313 E. Algonquin Road
Schaumburg, Illinois 60172 U.S.A.
Phone: 312-397-1000
TWX: 910-693-1592 or 1599
Telex: 722443 or 722424
Cable: MOTOL

5.5

FACTORY ADDRESS FOR CRYSTAL, CHANNEL ELEMENT, ACTIVE FILTER, CODE PLUGS AND RESONANT REED ORDERS

AIR MAIL ORDERS

Motorola, Inc.
Component Products Sales & Service
P.O. Box 66191
O'Hare International Airport
Chicago, Ill. 60666

REGULAR MAIL ORDERS AND CORRESPONDENCE

Motorola, Inc.
Component Products Sales & Service
2553 Edgington Street
Franklin Park, Illinois 60131

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MOTOROLA

MODEL CHART

FOR

450-512 MHz 15 W AND 25 W RF POWER

"MOCOM® •70" MOBILE FM TWO-WAY RADIO

"DIGITAL PRIVATE-LINE" CODED SQUELCH

BASIC RADIO MODELS

(LATER VERSION)

CODE:

- ☒ X = ONE ITEM SUPPLIED
- ☒ = ONE ITEM SUPPLIED DEPENDENT UPON FREQUENCY RANGE
- ☐ 0 = ONE ITEM SUPPLIED FOR FIVE OR LESS RADIO SETS
- ☐ 2 = NUMBER INDICATES QUANTITY SUPPLIED

| | | TRANSMITTER FREQUENCIES | RECEIVER FREQUENCIES | TRANSMITTER RF POWER |
|-----------|--|-------------------------|----------------------|----------------------|
| | | MODEL NUMBER | | |
| | | U24BBA-6000AA | 1 | 15 W |
| | | U24BBA-6300AA | 2 | 15 W |
| | | U24BBA-6900AA | 4 | 15 W |
| | | U24BBA-6100AA | 1 | 15 W |
| | | U34BBA-6000AA | 1 | 25 W |
| | | U34BBA-6300AA | 2 | 25 W |
| | | U34BBA-6900AA | 4 | 25 W |
| | | U34BBA-6100AA | 2 | 25 W |
| ITEM | DESCRIPTION | | | |
| TLE6592B | CIRCUIT BOARD (SINGLE-FREQUENCY) 450-470 MHz | | | |
| TLE6593B | CIRCUIT BOARD (SINGLE-FREQUENCY) 470-494 MHz | | | |
| TLE6594B | CIRCUIT BOARD (SINGLE-FREQUENCY) 494-512 MHz | | | |
| TLE6612B | CIRCUIT BOARD (MULTI-FREQUENCY) 450-470 MHz | | | |
| TLE6613B | CIRCUIT BOARD (MULTI-FREQUENCY) 470-494 MHz | | | |
| TLE6614B | CIRCUIT BOARD (MULTI-FREQUENCY) 494-512 MHz | | | |
| TFE6153A | HARMONIC FILTER (450-470 MHz) | | | |
| TFE6154A | HARMONIC FILTER (470-494 MHz) | | | |
| TFE6155A | HARMONIC FILTER (494-512 MHz) | | | |
| TLE1552A | POWER AMPLIFIER (450-470 MHz) | | | |
| TLE1553A | POWER AMPLIFIER (470-494 MHz) | | | |
| TLE1554A | POWER AMPLIFIER (494-512 MHz) | | | |
| TLE6603A | INJECTION TRIPLER (450-470 MHz) | | | |
| TLE6604A | INJECTION TRIPLER (470-494 MHz) | | | |
| TLE6605A | INJECTION TRIPLER (494-512 MHz) | | | |
| TLE6573A | VARACTOR MULTIPLIER (450-470 MHz) | | | |
| TLE6574A | VARACTOR MULTIPLIER (470-494 MHz) | | | |
| TLE6575A | VARACTOR MULTIPLIER (494-512 MHz) | | | |
| TLE6583A | RECEIVER RF DECK (450-470 MHz) | | | |
| TLE6584A | RECEIVER RF DECK (470-494 MHz) | | | |
| TLE6585A | RECEIVER RF DECK (494-512 MHz) | | | |
| TFN1000AS | RECEIVER FILTER | X | X | X |
| TLN4473A | CIRCUIT PROTECTION KIT | X | X | X |
| TLN4476A | ANTENNA SWITCH KIT | X | X | X |
| TLN4836A | CHASSIS HARDWARE KIT | X | X | X |
| TKN6491B | INTERCABLE KIT (SINGLE-FREQUENCY) | X | X | X |
| TKN6492B | INTERCABLE KIT (MULTI-FREQUENCY) | X | X | X |
| TLN8427A | NEGATIVE GROUND PLUG KIT | X | X | X |
| TLN5817A | DIGITAL "PRIVATE-LINE" ENCODER-DECODER | X | X | X |
| TRN6005A | CODE PLUG | X | X | X |
| KXN1002A | CHANNEL RESONATOR, TRANSMITTER | X | 2 | 4 |
| K1018A | CHANNEL RESONATOR, RECEIVER | X | 2 | 4 |
| THN6113A | FRONT PANEL & HOUSING KIT | X | X | X |
| TLN4474A | TUNING TOOL KIT | 0 | 0 | 0 |

EPS-18015-A

MOTOROLA

MODEL CHART

FOR

+50-512 MHz 15 W AND 25 W RF POWER

"MOCOM"® .70" MOBILE FM TWO-WAY RADIO

"DIGITAL PRIVATE-LINE" CODED SOUCLCH

PACKAGE RADIO SET MODELS

(LATER VERSION)

CODE:

X = ONE ITEM SUPPLIED

* REFER TO THE BASIC RADIO SET MODEL CHART
FOR MODEL COMPLEMENT

[illegible]

EPS-18016-A

MODEL CHART
FOR
450-512 MHz
14 W AND 22/25 W RF POWER
"MOCOM • 70" BASIC RADIO SETS

☐ X = ONE ITEM SUPPLIED
☒ = ONE ITEM SUPPLIED DEPENDENT ON FREQUENCY RANGE
☐ - = ONE ITEM SUPPLIED FOR FIVE OR LESS RADIO SETS
☐ 2 = NUMBER INDICATES QUANTITY SUPPLIED

= SEE UNIFIED CHASSIS CHART FOR KIT COMPLEMENT.

[illegible]

EPS-17016-O

UNIFIED CHASSIS KIT COMPLEMENT

| UNIFIED CHASSIS KIT COMPLEMENT | | TUE1191BB 1-F 450-470 MHz | | TUE1221BK 4-F 450-470 MHz | | TUE1314AB 1-F 470-494 MHz | | TUE1315AB 1-F 494-512 MHz | | TUE1314AK 4-F 470-494 MHz | | TUE1315AK 4-F 494-512 MHz | |
|--------------------------------|-------------------------------------|------------------------------|---|------------------------------|---|------------------------------|---|------------------------------|---|------------------------------|---|------------------------------|---|
| KIT | DESCRIPTION | | | | | | | | | | | | |
| TFE6153A | Harmonic Filter | X | X | | | | | | | | | | |
| TFE6154A | Harmonic Filter | | | X | | | | X | | | | | |
| TFE6155A | Harmonic Filter (494-512 MHz) | | | | | | X | | | | X | | |
| TFN1000AS | Receiver Filter | X | X | X | X | X | X | X | X | X | X | X | X |
| TKN6491B | Interconnect Cable (1-Freq.) | X | | | | | | | | | | | |
| TKN6492B | Interconnect Cable (4-Freq.) | | | X | | | | | X | | X | | |
| TLE1552A | Power Amplifier (450-470 MHz) | X | X | | | | | | | | | | |
| | Includes: | | | | | | | | | | | | |
| TLE8142A | Power Amplifier Board | | | | | | | | | | | | |
| TLN4837A | Heatsink & Hardware Kit | | | | | | | | | | | | |
| TLE1553A | Power Amplifier (470-494 MHz) | | | | X | | | | X | | | | |
| | Includes: | | | | | | | | | | | | |
| TLE8143A | Power Amplifier Board | | | | | | | | | | | | |
| TLN4837A | Heatsink & Hardware Kit | | | | | | | | | | | | |
| TLE1554A | Power Amplifier (494-512 MHz) | | | | | | X | | | | X | | |
| | Includes: | | | | | | | | | | | | |
| TLE8144A | Power Amplifier Board | | | | | | | | | | | | |
| TLN4837A | Heatsink & Hardware Kit | | | | | | | | | | | | |
| TLE6573A | Varactor Multiplier (450-470 MHz) | X | X | | | | | | | | | | |
| TLE6574A | Varactor Multiplier (470-494 MHz) | | | | X | | | | X | | | | |
| TLE6575A | Varactor Multiplier (494-512 MHz) | | | | | | X | | | | X | | |
| TLE6583A | RF Deck Kit (450-470 MHz) | X | X | | | | | | | | | | |
| TLE6584A | RF Deck Kit (470-494 MHz) | | | | X | | | | X | | | | |
| TLE6585A | RF Deck Kit (494-512 MHz) | | | | | | X | | | | X | | |
| TLE6603A | Injection Tripler Kit (450-470 MHz) | X | X | | | | | | | | | | |
| TLE6604A | Injection Tripler Kit (470-494 MHz) | | | | X | | | | X | | | | |
| TLE6605A | Injection Tripler Kit (494-512 MHz) | | | | | | X | | | | X | | |
| TLN4473A | Antenna Switch Kit | X | X | X | X | X | X | X | X | X | X | X | X |
| TLN4476A | Antenna Switch Kit | X | X | X | X | X | X | X | X | X | X | X | X |
| TLN4836A | Chassis & Hardware Kit | X | X | X | X | X | X | X | X | X | X | X | X |
| TLN8427A | Negative Ground Plug Kit | X | X | X | X | X | X | X | X | X | X | X | X |
| TLE6612B | Multi-Frequency Board (450-470 MHz) | | X | | | | | | | | | | |
| TLE6613B | Multi-Frequency Board (470-494 MHz) | | | | | | | | | X | | | |
| TLE6614B | Multi-Frequency Board (494-512 MHz) | | | | | | | | | | | X | |
| TLE6592B | 1-Frequency Board (450-470 MHz) | X | | | | | | | | | | | |
| TLE6593B | 1-Frequency Board | | | | X | | | | | | | | |
| TLE6594B | 1-Frequency Board (494-512 MHz) | | | | | | | X | | | | | |

EPS-17019-O

MOTOROLA

MODEL CHART

FOR

450-512 MHz

"MOCOM - 70" RADIO SETS

TRUNK-MOUNT PACKAGE MODELS

CODE:

[X] = ONE ITEM SUPPLIED

(*) = SEE BASIC RADIO SET CHART FOR RADIO SET COMPLEMENT.

| | | MODEL NUMBER | | BASIC RADIO SET (*) | DESCRIPTION | | RF POWER |
|-----------|--|---------------|---------------|---------------------|--|--|----------|
| ITEM | | DESCRIPTION | | | | | |
| | | | | | CARRIER SQUELCH MODELS | | |
| ICN6098CF | CONTROL HEAD (1-FREQ.) DUAL-PURPOSE W/DIMMER | T24BBA-1000AK | U24BBA-1000AA | | 1-FREQUENCY | | 14 W |
| ICN6136BF | CONTROL HEAD (C2-R1) DUAL-PURPOSE W/DIMMER | T24BBA-1100AK | U24BBA-1100AA | | 2-FREQ. XMIT, 1-FREQ. RECEIVE | | 14 W |
| ICN6098CF | CONTROL HEAD (2-FREQ.) DUAL-PURPOSE W/DIMMER | T24BBA-1300AK | U24BBA-1300AA | | 2-FREQUENCY | | 14 W |
| ICN6098CJ | CONTROL HEAD (4-FREQ.) DUAL-PURPOSE W/DIMMER | T24BBA-1900AK | U24BBA-1900AA | | 4-FREQUENCY | | 14 W |
| TKN6055A | CABLE KIT (17-FT) SINGLE-FREQ. | T34BBA-1000AK | U34BBA-1000AA | | 1-FREQUENCY | | 22/25 W |
| TKN6056A | CABLE KIT (17-FT) MULTI-FREQ. | T34BBA-1100AK | U34BBA-1100AA | | 2-FREQ. XMIT, 1-FREQ. RECEIVE | | 22/25 W |
| IAF6052A | ANTENNA (450-470 MHz) | T34BBA-1300AK | U34BBA-1300AA | | 2-FREQUENCY | | 22/25 W |
| IAF6054A | ANTENNA (470-512 MHz) | T34BBA-1900AK | U34BBA-1900AA | | 4-FREQUENCY | | 22/25 W |
| TAE6062A | ANTENNA (450-470 MHz) | | | | | | |
| ILN6042A | INSTALLATION KIT | | | | | | |
| IMN6013A | MICROPHONE | | | | | | |
| TSN6000A | SPEAKER | | | | | | |
| | | | | | "PRIVATE-LINE" TONE-CODED SQUELCH MODELS | | |
| | | T24BBA-3000AK | U24BBA-3000AA | | 1-FREQUENCY | | 14 W |
| | | T24BBA-3100AK | U24BBA-3100AA | | 2-FREQ. XMIT, 1-FREQ. RECEIVE | | 14 W |
| | | T24BBA-3300AK | U24BBA-3300AA | | 2-FREQUENCY | | 14 W |
| | | T24BBA-3900AK | U24BBA-3900AA | | 4-FREQUENCY | | 14 W |
| | | T34BBA-3000AK | U34BBA-3000AA | | 1-FREQUENCY | | 22/25 W |
| | | T34BBA-3100AK | U34BBA-3100AA | | 2-FREQ. XMIT, 1-FREQ. RECEIVE | | 22/25 W |
| | | T34BBA-3300AK | U34BBA-3300AA | | 2-FREQUENCY | | 22/25 W |
| | | T34BBA-3900AK | U34BBA-3900AA | | 4-FREQUENCY | | 22/25 W |

EPS-17017-O

MOTOROLA

MODEL CHART

FOR

450-512 MHz

"MOCOM • 70" RADIO SETS

DASH-MOUNT PACKAGE MODELS

CODF:

☒ = ONE ITEM SUPPLIED

(*) = SEE BASIC RADIO SET CHART FOR RADIO SET COMPLEMENT.

| ITEM | DESCRIPTION | | D24BB | D24BB | D24BB | D24BB | D24BB | D24BB | D24BB | D24BB | D24BB |
|-----------|--|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| TCN6141BE | CONTROL HEAD (1-FREQ.) DUAL-PURPOSE W/DIMMER | X | X | | X | | X | | X | | |
| TCN6141BF | CONTROL HEAD (2-FREQ.) DUAL-PURPOSE W/DIMMER | | X | | X | | X | | X | | |
| TCN6141BJ | CONTROL HEAD (4-FREQ.) DUAL-PURPOSE W/DIMMER | | | X | X | | | X | X | | |
| TAE6052A | ANTENNA (450-470 MHz) | | | X | X | | | | X | X | |
| TAE6054A | ANTENNA (470-512 MHz) | | | X | X | | | | X | X | X |
| ILN4208A | INSTALLATION KIT | X | X | X | | X | X | X | X | X | X |
| TMN6013A | MICROPHONE | X | X | X | X | X | X | X | X | X | X |
| TSN6000A | SPEAKER | X | X | X | X | X | Y | X | X | X | X |
| | | | | | | | | | | | |

EPS-17018-O

MODEL CHART

FOR

450-470 MHz

"MOCOM-70" BASIC RADIO SETS

CODE:

- ☒ X = ONE ITEM SUPPLIED
- ☒ = ONE ITEM SUPPLIED FOR FIVE OR LESS RADIO SETS
- ☒ 2 = NUMBER INDICATES QUANTITY SUPPLIED

| MODEL CHART FOR 450-470 MHz "MOCOM-70" BASIC RADIO SETS | | | | |
|--|--|----------------------|-----------|--|
| MODEL NUMBER | TRANSMITTER FREQUENCIES CARRIER SQUELCH | RECEIVER FREQUENCIES | ITEM | DESCRIPTION |
| C44BBN-1100A | 1 | 1 | TLE1552A | POWER AMPLIFIER (FORMERLY TLE1302A) |
| C44BBN-1130A | 2 | 2 | TLE6592A | SINGLE-FREQ. CIRCUIT BOARD |
| C44BBN-1190A | 4 | 4 | TLE6612A | TWO & FOUR-FREQ. CIRCUIT BOARD |
| C44BBN-1100A | 1 | 1 | TLE6573A | VARACTOR MULTIPLIER |
| C44BBN-1130A | 2 | 2 | TFE6153A | HARMONIC FILTER |
| C44BBN-1190A | 4 | 4 | TFN1000AS | RECEIVER FILTER (FORMERLY TFN6027AS) |
| C44BBN-1100A | 1 | 1 | TLE6583A | RF DECK |
| C44BBN-1130A | 2 | 2 | TLE6603A | INJECTION TRIPLER |
| C44BBN-1190A | 4 | 4 | TLN4473A | POWER-TEMPERATURE MONITOR CIRCUIT BOARD |
| C44BBN-1100A | 1 | 1 | TLN4475A | CHASSIS AND HARDWARE KIT |
| C44BBN-1130A | 2 | 2 | TKN6491A | INTERCABLING KIT, SINGLE-FREQUENCY |
| C44BBN-1190A | 4 | 4 | TKN6492A | INTERCABLING KIT, MULTI-FREQUENCY |
| C44BBN-1100A | 1 | 1 | TLN6824A | "VIBRASENDER" RESONANT REED |
| C44BBN-1130A | 2 | 2 | TLN8381A | "VIBRASPONDER" RESONANT REED |
| C44BBN-1190A | 4 | 4 | TLN4448A | "PRIVATE-LINE" ENCODER-DECODER CIRCUIT BOARD |
| C44BBN-1100A | 1 | 1 | THN6113A | HOUSING KIT |
| C44BBN-1130A | 2 | 2 | TLN4474A | TUNING TOOL KIT |
| C44BBN-1190A | 4 | 4 | TLN4427A | NEGATIVE GROUND KIT |
| C44BBN-1100A | 1 | 1 | TLN1476A | ANTENNA SWITCH |
| C44BBN-1130A | 2 | 2 | KXN1002A | CHANNEL RESONATOR, TRANSMITTER (FORMERLY K1017A) |
| C44BBN-1190A | 4 | 4 | K1018A | CHANNEL RESONATOR, RECEIVER |

EPS-7478-A

MODEL CHART
FOR
470-512 MHz
"MOCOM-70" BASIC RADIO SET

CODE:

- ☒ ONE ITEM SUPPLIED
☒ = ONE ITEM SUPPLIED DEPENDENT ON FREQUENCY RANGE
☒ ONE ITEM SUPPLIED FOR FIVE OR LESS RADIO SETS
☒ : NUMBER INDICATES QUANTITY SUPPLIED

| MODEL NUMBER | RF POWER | TRANSMITTER FREQUENCIES | RECEIVER FREQUENCIES | ITEM | DESCRIPTION |
|--|----------|-------------------------|----------------------|-----------|--|
| CARRIER SQUELCH MODELS | | | | | |
| U24BCA-1000AA | 16 W | 1 | 1 | TLE1553A | POWER AMPLIFIER (470-494 MHz) FORMERLY TLE1303A |
| U24BCA-1300AA | 16 W | 2 | 2 | TLE1554A | POWER AMPLIFIER (494-512 MHz) FORMERLY TLE1304A |
| U24BCA-1900AA | 16 W | 4 | 4 | TLE6523A | SINGLE-FREQUENCY CIRCUIT BOARD (470-494 MHz) |
| U34BCA-1000AA | 22 W | 1 | 1 | TLE6594A | SINGLE-FREQUENCY CIRCUIT BOARD (494-512 MHz) |
| U34BCA-1300AA | 22 W | 2 | 2 | TLE6613A | TWO & FOUR-FREQUENCY CIRCUIT BOARD (470-494 MHz) |
| U34BCA-1900AA | 22 W | 4 | 4 | TLE6614A | TWO & FOUR-FREQUENCY CIRCUIT BOARD (494-512 MHz) |
| "PRIVATE-LINE" TONE-CODED SQUELCH MODELS | | | | | |
| U24BCA-3000AA | 16 W | 1 | 1 | TLE6574A | VARACTOR MULTIPLIER (470-494 MHz) |
| U24BCA-3300AA | 16 W | 2 | 2 | TLE6575A | VARACTOR MULTIPLIER (494-512 MHz) |
| U24BCA-3900AA | 16 W | 4 | 4 | TFE6154A | HARMONIC FILTER (470-494 MHz) |
| U34BCA-3000AA | 22 W | 1 | 1 | TFE6155A | HARMONIC FILTER (494-512 MHz) |
| U34BCA-3300AA | 22 W | 2 | 2 | TFN1000AS | RECEIVER FILTER |
| U34BCA-3900AA | 22 W | 4 | 4 | TLE6584A | RF DECK (470-494 MHz) |
| WIDE-SPACED TRANSMITTER CHANNELS | | | | | |
| U24BCA-1103AA | 16 W | 2 | 1 | TLE6585A | RF DECK (494-512 MHz) |
| U34BCA-1103AA | 22 W | 2 | 1 | TLE6604A | INJECTION TRIPLER (470-494 MHz) |
| U24BCA-3103AA | 16 W | 2 | 1 | TLE6605A | INJECTION TRIPLER (494-512 MHz) |
| U34BCA-3103AA | 22 W | 2 | 1 | TLN4473A | POWER-TEMPERATURE MONITOR CIRCUIT BOARD |
| U34BCA-3103AA | 22 W | 2 | 1 | TLN4836A | CHASSIS AND HARDWARE KIT |
| U34BCA-3103AA | 22 W | 2 | 1 | TKN6491A | INTERCABLING KIT, SINGLE-FREQUENCY |
| U34BCA-3103AA | 22 W | 2 | 1 | TKN6992A | INTERCABLING KIT, MULTI-FREQUENCY |
| U34BCA-3103AA | 22 W | 2 | 1 | TLN6824A | "VIBRASENDER" RESONANT REED |
| U34BCA-3103AA | 22 W | 2 | 1 | TLN8381A | "VIBRASPONDER" RESONANT REED |
| U34BCA-3103AA | 22 W | 2 | 1 | TLN4448A | "PRIVATE-LINE" ENCODER-DECODER CIRCUIT BOARD |
| U34BCA-3103AA | 22 W | 2 | 1 | THN6113A | HOUSING KIT |
| U34BCA-3103AA | 22 W | 2 | 1 | TLN4474A | TUNING TOOL KIT |
| U34BCA-3103AA | 22 W | 2 | 1 | TLN8427A | NEGATIVE GROUND KIT |
| U34BCA-3103AA | 22 W | 2 | 1 | TLN4476A | ANTENNA SWITCH |
| U34BCA-3103AA | 22 W | 2 | 1 | KXN1002A | CHANNEL RESONATOR, TRANSMITTER |
| U34BCA-3103AA | 22 W | 2 | 1 | K1018A | CHANNEL RESONATOR, RECEIVER |

MOTOROLA

MODEL CHART

FOR

450-470 MHz

"MOCOM - 70" RADIO SETS

WITH ACCESSORIES

VERSION 2

CODE:

[X] = ONE ITEM SUPPLIED

☒ = ONE ITEM SUPPLIED DEPENDENT ON FREQUENCY RANGE.

*SEE BASIC RADIO SET MODEL CHART FOR RADIO SET COMPLEMENT

[illegible]

EPS-7659-A

MOTOROLA

MODEL CHART

FOR

450-470 MHz

"MOCOM - 70" RADIO SETS

WITH ACCESSORIES

VERSION 1

CODE:

X = ONE ITEM SUPPLIED

*SEE BASIC RADIO SET MODEL CHART FOR RADIO SET COMPLEMENT

[illegible]

EPS-4831-A

MOTOROLA

MODEL CHART

FOR

470-512 MHz

"MOCOM" 70" RADIO SETS

WITH ACCESSORIES

CODE:

* = SEE BASIC RADIO SET MODEL CHART FOR RADIO SET COMPLEMENT

☒ = ONE ITEM SUPPLIED

☒ = OPTIONAL ANTENNA. THE ANTENNA USED WITH THE RADIO SET DETERMINES EFFECTIVE RADIATED POWER (ERP) AS FOLLOWS:

| ANTENNA | RADIO SET RF POWER | ERP |
|---------------------------------|-----------------------|------|
| TAE6054A (Unity Gain) | 16 W | 10 W |
| TAE6074A/75A (3-1/2 dB Gain) | 16 W | 25 W |
| TAE6064A/65A (5 dB Gain) | 22 W | 50 W |

OTHER COMBINATIONS OF RADIOS AND ANTENNAS ARE NOT RECOMMENDED.

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EPS-8065-C

DESCRIPTION

1. INTRODUCTION

The Motorola "Mocom-70" radios are completely transistorized mobile FM two-way units which fully utilize the advantages of solid-state circuits -- reliability, small size, ruggedness and low maintenance requirements. Current demands are low, since tube filaments are eliminated and unheated crystals are used for frequency control.

These radio sets can utilize existing "Motrac" accessories. The units may be installed so that the control head ON-OFF switch turns on the transmitter and receiver or the receiver alone. In the latter case, power for the transmitter is routed through the vehicle ignition switch, so that transmission is impossible unless the ignition switch is turned on.

A variety of models are available which provide carrier squelch or "Private-Line" tone-coded squelch operation. The model chart at the front of this manual lists the available models.

2. TRANSMITTERS

Complete transistorization of the FM transmitter and the use of unheated crystals allow instantaneous on-frequency transmission over an ambient temperature range of -30°C to +60°C as soon as power is applied. Modulation is effected by a direct frequency modulator. The frequency of the modulated signal is multiplied and then applied to the amplifier output stages. The output frequency is 27 times the crystal frequency. A high level of spurious frequency attenuation is achieved in a four section harmonic filter in the transmitter output. The transmitter provides a minimum output of 25 watts in the 450-470 MHz range and an effective radiated power of 10 watts, 25 watts or 50 watts in the 470-512 MHz range.

3. RECEIVERS

The receivers used in these radio sets are crystal-controlled, dual conversion models which provide five watts of audio power. A highly selective rf preselector (tuned cavities), a high i-f crystal filter and a sealed, life-time guaranteed "Permakay" filter in the low i-f stages determine the excellent bandwidth and

selectivity characteristics of the receivers. Plug-in resonators provide stable frequency control.

These models include a noise-actuated squelch circuit consisting of a noise limiter, a noise detector and a dc control stage (switching circuit) to cut off the audio amplifier. This eliminates disturbing noise which would otherwise be heard at the speaker during intervals between received messages.

4. "DIGITAL PRIVATE-LINE" (DPL) AND TONE "PRIVATE-LINE" (TPL) SQUELCH MODELS

This type of radio set is an improvement in FM two-way radio equipment especially when operating under crowded channel conditions. Several networks, using either DPL or TPL, can use the same rf carrier frequency in the same area if each network uses a different code (in DPL) or a different tone (in TPL).

The transmitters are modulated by a continuous sub-audible code signal (digital or tone) in addition to the voice modulation. The receivers accept only signals which are modulated with the correct tone or digital code and reject all others.

Both DPL and TPL squelch models also include noise-actuated squelch circuitry as previously described for carrier squelch models. This enables the operator to monitor the channel before transmissions and prevent interference with other users of the frequency.

In DPL or TPL squelch models, the decoding circuits are operative at all times. The monitor-operate switch and the hook-switch on the hang-up switch box, when a dual-purpose control head is used, places the noise-actuated squelch circuit in or out of operation.

In "Private-Line" tone-coded squelch models, the SQUELCH control determines the composite dual-squelch sensitivity. In normal operation, the receiver audio is activated only when both of the following conditions occur:

- a. An on-frequency rf signal must be received to disable the noise (carrier squelch) circuit.

b. The on-frequency rf signal must be FM modulated with the proper sub-audible tone frequency to activate the "Private-Line" decoder. In "Digital Private-Line" binary-coded squelch models, squelch is only controlled by the "Digital Private-Line" decoder output.

5. NETTING FEATURES

The netting feature provides a quick method of checking the frequency of either the transmitter or the receiver if both are aligned to the same frequency and if one is known to be "on-frequency". With the Motorola Portable Test Set, the test can be made in one simple operation.

Plug the test set into either meter socket and switch the test set meter to position #4. The meter will indicate the discriminator output. Remote one end of the wire netting jumper, located near L105 in the exciter from its normal pin and connect it to the pin located near CR180 in the exciter IDC circuit. This energizes the low level stages of the transmitter exciter and causes a signal to be radiated to the receiver. The receiver or transmitter oscillator can then be "warped" on-frequency by adjusting for zero discriminator output.

6. HOUSING

The basic radio set consists of a transmitter and receiver housed together to form a drawer unit which slides into the #16 gauge housing. All external connections are made through receptacles on the front panel.

The radio set housing can be mounted either under the vehicle dashboard or in the trunk. The same drawer assembly, including transmitter and receiver, slides into the housing in either type of installation. In mobile radio fleets, where both dash- and trunk-mount installations are used, this design provides full flexibility in exchanging radio sets between vehicles. Trunk-mounted radio sets are remotely controlled by means of a dash-mounted control head.

A removable handle is attached to the front panel. It can be removed by loosening the two screws located on the bottom ends of the handle. A key lock is also mounted on the front panel to secure the radio from unauthorized persons.

For servicing purposes, the major chassis is easily accessible by removing the drawer unit from the housing. Refer to the SERVICE AIDS section of this manual for instructions on the removal of individual components.

7. ACCESSORIES

In addition to the basic radio set, accessories are required to complete the installation. Various

combinations of accessories are available to meet specific requirements. The accessories are listed in the Model Chart in the front part of this manual.

The control heads available as one of the accessories provide all the required control facilities for operation of the radio set. The dash-mount control heads plug directly into the front panel when the handle is removed. Control heads for trunk-mounted units have an adjustable angle-bracket for mounting to the vehicle dash and are connected to the radio set via a cable kit.

The microphone used with the radio set is a palm-type microphone with a transistorized preamplifier. The microphone has a 12-inch tinsel coiled-cord and a four-pin connector for plugging into the receptacle on the control head.

A special mounting kit is included with the dash-mount accessories to mount the radio set in the passenger compartment of the vehicle.

8. OPTIONAL ACCESSORIES

The following options are available to meet specific customer requirements:

● TLN1097A Time-Out Timer - This option prevents extended transmitter keying.

● TLN8482A Ground Reversing Kit - This kit is required for positive ground operation.

● Dimmer Control Head - This option is available for all trunk-mounted radio set control heads. (Dash-mount dimmer control heads are standard equipment.)

● TLE6532A Receiver Preamplifier - This option improves receiver sensitivity by 6 dB, thereby extending the range of communications.

Additional options are available that allow the customer to delete antennas, speakers, microphones or "Private-Line" hang-up brackets from the package model equipment complements.

Many other accessories are available; some are given here. Contact your local Motorola Radio Communications Representative for complete details or for information on other accessories.

● Mobile Coaxial Antenna - where rooftop antenna is not practical or desirable.

● 5 dB Gain Antenna - for improved system performance.

● Dynamic Handset - where telephone type handset is either preferred or where speaker muting is desired for privacy.

INSTALLATION AND OPERATION

INSTALLING THE RADIO SET

Complete installation instructions are packed in the shipping carton with the radio set. Install the radio set according to the instructions supplied.

IMPORTANT

DO NOT CUT ANTENNA CABLE unless absolutely necessary. If cable must be shortened, reduce power output of transmitter as indicated in the table to maintain FCC approved Effective Radiated Power (ERP). Standard cable length is 14 feet.

| Antenna Model | Radio Model Series | LENGTH OF CABLE (FEET) | | | | | | ERP |
|---------------|--------------------|------------------------|-----|-----|-----|-----|-----|-----|
| | | 4 | 6 | 8 | 10 | 12 | 14 | |
| TAE6054A | T/D/U24BBA/BCA | 10W | 11W | 12W | 13W | 14W | 15W | 10W |
| TAE6074A | T/D/U24BBA/BCA | 10W | 11W | 12W | 13W | 14W | 15W | 25W |
| or | | | | | | | | |
| TAE6075A | | | | | | | | |
| TAE6064A | T/D/U34BBA/BCA | 16W | 17W | 18W | 19W | 20W | 21W | 50W |
| or | | | | | | | | |
| TAE6065A | | | | | | | | |



1. OPERATING INSTRUCTIONS

CAUTION

This radio set, when supplied with a Model TLN8427A Negative Ground Kit, must be used in negative ground installations only. For positive ground installations, a Model TLN8482A Ground Reversing Kit is available. This kit must be inserted in the socket with the POS GND mark opposite the arrow on the polarity plug plate when used in positive ground installations. This ground reversing kit may be used in negative ground installations also. In such cases, the kit must be inserted in the socket with the NEG GND mark opposite the arrow on the polarity plug plate.

NOTE

Depending on the type of control head being used, the procedure for placing the radio in or out of "Private-Line" operation (hereafter referred to as PL mode) may vary. Refer to the following:

--Dual-Purpose Control Heads - these control heads do not contain a "PL" ON-OFF switch. To place the radio in the PL mode, set the monitor-operate switch on the hang-up switch box to the operate (opposite ) position. To take the radio out of the PL mode, place the monitor-operate switch in the monitor () position.

--All other control heads - these control heads contain a "PL" ON-OFF switch. By placing the switch in the appropriate position, the PL mode will be either on or off.

TO RECEIVE

| | |
|-------------------------|--|
| MULTI-FREQ. MODELS ONLY | Place the frequency selector switch in the desired position. |
| ALL MODELS | Place the ON-OFF switch in the ON position or turn the OFF-VOLUME control clockwise. The green lamp will go on to indicate the "standby" condition. The receiver is in full operation. |

TO HEAR ALL ON-FREQUENCY SIGNALS

| | |
|----------------------------|---|
| "PRIVATE-LINE" MODELS ONLY | Take the radio out of the PL mode. |
| ALL MODELS | Turn the SQUELCH control to the full counterclockwise position. Turn the VOLUME control clockwise until noise is heard. Adjust the SQUELCH control by turning it slowly clockwise until the noise is just squelched (cuts out). Set the VOLUME control to the desired listening level with a received signal. |

TO HEAR "PRIVATE-LINE" SIGNALS ONLY

| | |
|----------------------------|---|
| "PRIVATE-LINE" MODELS ONLY | Take the radio out of the PL mode. |
| | Turn the SQUELCH control to the full counterclockwise position. Turn the VOLUME control clockwise until noise is heard. Adjust the SQUELCH control by turning it slowly clockwise until the noise is just squelched (cuts out). Place the radio in the PL mode. Set the VOLUME control to the desired listening level with a received signal. |

TO TRANSMIT

ALL MODELS

Proceed as previously described under "TO RECEIVE" and "TO HEAR ALL ON-FREQUENCY SIGNALS". Turn "on" the vehicle ignition switch. For short transmissions it is not necessary to start the engine; however, to conserve the battery, the engine should be running. When the channel is clear, hold the microphone about one inch from the lips and turned about 30° away from the face. Press the push-to-talk button. The red lamp will come on and the transmitter will go "on the air". Speak slowly and clearly across the microphone in a normal or slightly louder than normal voice. At the end of the message, release the push-to-talk button and replace the microphone in the hang-up bracket.

CAUTION

To prevent accidental transmission or jamming of the channel by inadvertent keying of the transmitter, do not leave the microphone lying on the seat where the button may be accidentally operated.

TO TURN OFF

ALL MODELS

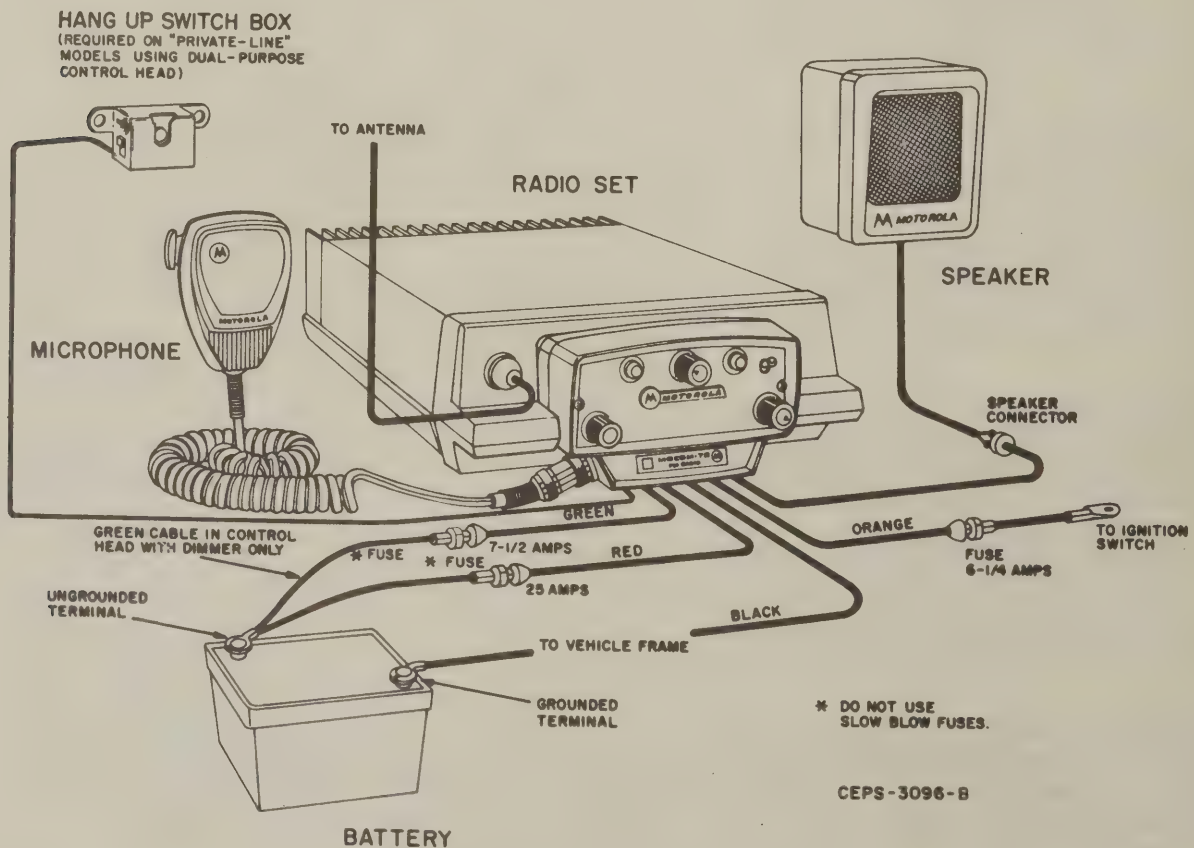
Place the ON-OFF switch in the OFF position -- or turn the OFF-VOLUME control counterclockwise until a click is heard.

2. LOW CURRENT DRAIN MODIFICATION

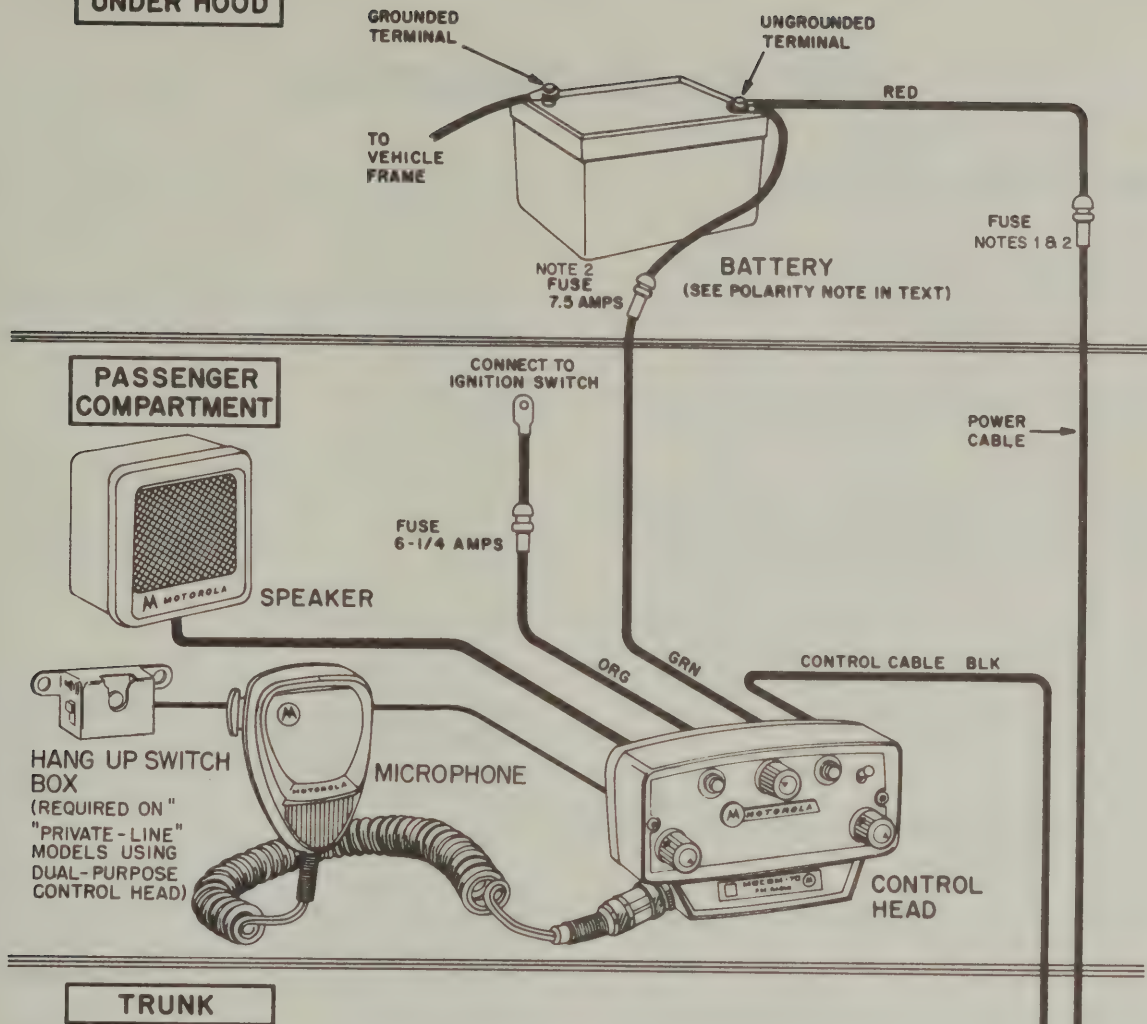
(Non-Dimmer Control Heads Only)

If desired, an additional saving in battery current drain of about 200 mA (in the standby condition) may be obtained by a wiring modification in the control head. If this modification is incorporated, the green pilot lamp will not operate unless the ignition switch is in the ON position. Proceed as follows to complete the modification.

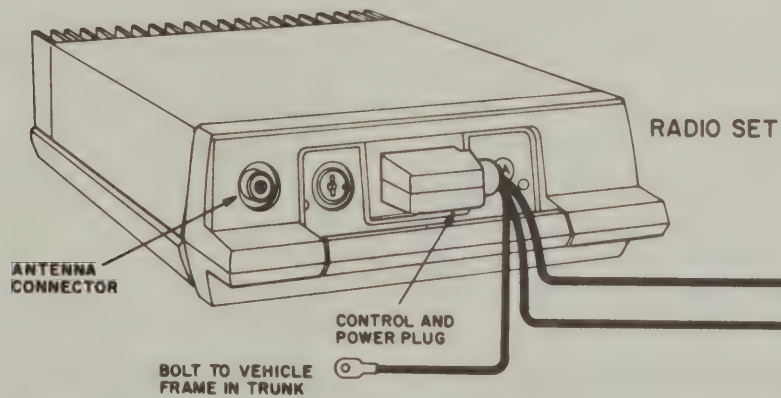
- a. Loosen the two mounting screws and remove the control head.
- b. Remove the end of the 33-ohm resistor attached to the green lamp from the terminal of the OFF-VOLUME control or the ON-OFF switch.
- c. Connect the end of the resistor which was removed in step b. to the terminal of the OFF-VOLUME control or the ON-OFF switch to which the red lamp is connected.



UNDER HOOD



TRUNK



NOTES:

1. 25A FUSE USED FOR 30W AND 45W MODELS. FOR HIGHER POWER MODELS USE 40A FUSE.
2. DO NOT USE SLOW BLOW FUSE.

CEPS-3097-D

Typical Trunk-Mount Installation

THEORY OF OPERATION

1. FUNCTIONAL OPERATION

The overall operation of the radio set is illustrated in the Functional Block Diagram in Figure 1. This diagram applies to both dash and trunk-mount installations.

The dc input to the radio is applied through three separate leads in the following manner:

- The primary power (12 volts from the ungrounded side of the battery) is applied to the transmitter via the polarity reversing socket and the relay.

- Power for the receiver and low level transmitter stages comes from the ungrounded terminal of the battery and passes through the OFF-ON switch (in the control head) and the polarity reversing socket.

- The transmitter keying voltage is connected to both the vehicle ignition switch and the OFF-ON switch in the control head. This gives vehicle ignition control to transmitter operation since the push-to-talk function will be inoperative with the ignition switch turned off.

The function of the polarity reversing socket is to provide voltages of the proper polarity to the radio circuitry in either positive or negative ground installations. With the exception of the audio push-pull output stages, the receiver and some circuits within the transmitter require a voltage which is always positive with respect to chassis. In positive ground systems, this voltage is supplied by the TLN8482A Ground Reversing Kit. In negative ground systems, connections through the polarity reversing socket are supplied by the TLN8427A Negative Ground Kit or by the TLN8482A Ground Reversing Kit (see the INSTALLATION AND OPERATION section of this manual).

When the control head ON-OFF switch is turned on, the receiver is immediately operative and the green lamp on the control head lights, indicating the radio set is ON.

In negative ground operation, battery voltage (A+) is applied to:

- The entire receiver.

- The transmitter audio amplifier.

- The PL encoder, decoder, and time delay circuits (in "Private-Line" radio sets only).

A regulated 9.1-volt supply (chassis referenced) is derived from the receiver A+ voltage. This regulated voltage is applied to:

- Both the transmitter and receiver oscillators.

- The transmitter IDC circuit.

- The PL tone generator (in "Private-Line" radio sets only).

- The time-out timer

In positive ground operation, the chassis referenced A+ is supplied by the converter in the TLN8482A Ground Reversing Kit. Other connections in this kit provide for maintaining the required A+ to A- polarity for the remaining circuits.

When the power ON-OFF switch and the vehicle ignition switch are both turned on, the transmitter is immediately ready for operation. When the push-to-talk button on the microphone is pressed, the following functions are performed:

- The red lamp in the control head lights indicating a transmit condition.

- A chassis connection is made through the push-to-talk switch to activate the relay (in "Private-Line" radios, the push-to-talk switch activates the PL time delay circuit which in turn switches the relay).

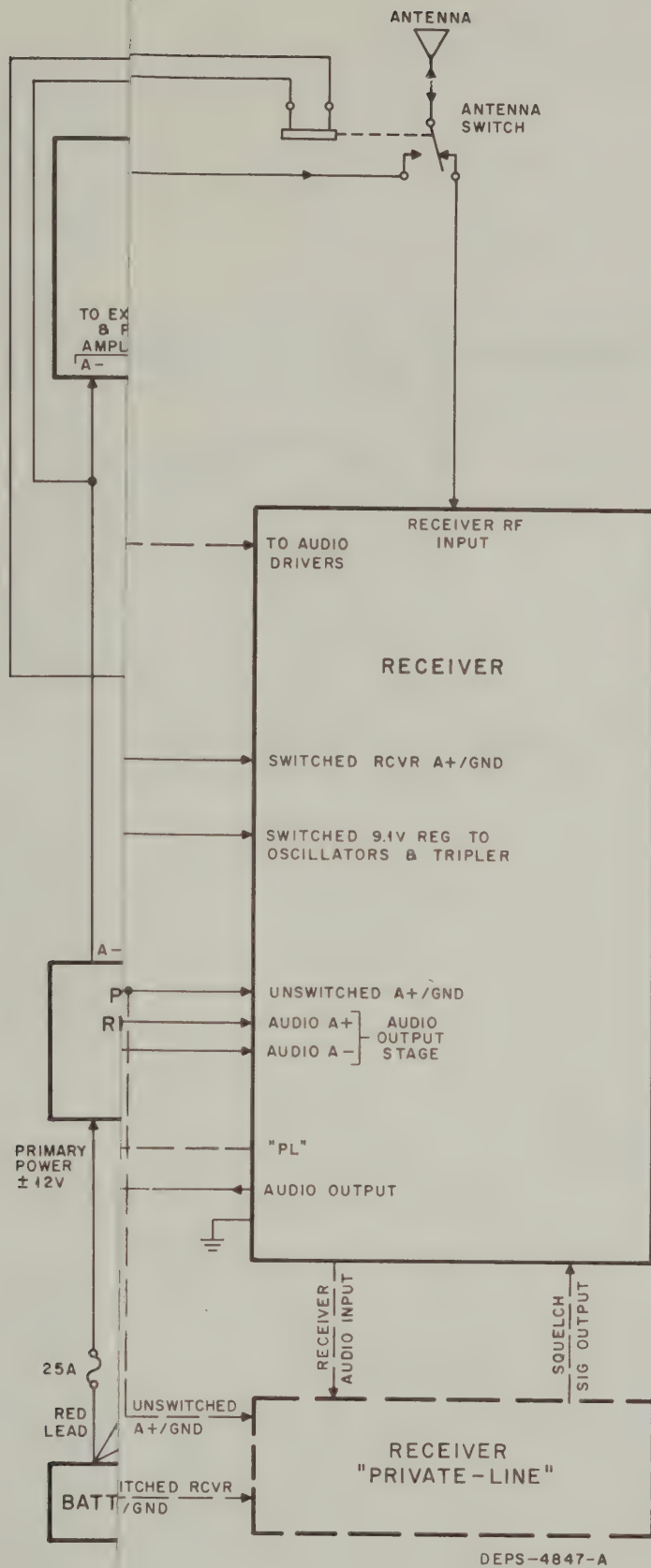
The power relay performs the following switching functions:

- Filtered A+ is provided to operate the low level transmitter exciter stages.

- Regulated 9.1 V is removed from the receiver oscillator and multipliers to turn them off.

- Unfiltered A+ is provided to switch the antenna from the receiver input to the transmitter input and to operate the high level transmitter stages.

When the push-to-talk button is released, the following takes place:



THEORY OF OPERATION

1. FUNCTIONAL OPERATION

The overall operation of the radio set is illustrated in the Functional Block Diagram in Figure 1. This diagram applies to both dash and trunk-mount installations.

The dc input to the radio is applied through three separate leads in the following manner:

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- The transmitter keying voltage is connected to both the vehicle ignition switch and the OFF-ON switch in the control head. This gives vehicle ignition control to transmitter operation since the push-to-talk function will be inoperative with the ignition switch turned off.

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When the control head ON-OFF switch is turned on, the receiver is immediately operative and the green lamp on the control head lights, indicating the radio set is ON.

In negative ground operation, battery voltage (A+) is applied to:

- The entire receiver.
- The transmitter audio amplifier.

- The PL encoder, decoder, and time delay circuits (in "Private-Line" radio sets only).

A regulated 9.1-volt supply (chassis referenced) is derived from the receiver A+ voltage. This regulated voltage is applied to:

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- The transmitter IDC circuit.

- The PL tone generator (in "Private-Line" radio sets only).

- The time-out timer

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When the power ON-OFF switch and the vehicle ignition switch are both turned on, the transmitter is immediately ready for operation. When the push-to-talk button on the microphone is pressed, the following functions are performed:

- The red lamp in the control head lights indicating a transmit condition.

- A chassis connection is made through the push-to-talk switch to activate the relay (in "Private-Line" radios, the push-to-talk switch activates the PL time delay circuit which in turn switches the relay).

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- Filtered A+ is provided to operate the low level transmitter exciter stages.

- Regulated 9.1 V is removed from the receiver oscillator and multipliers to turn them off.

- Unfiltered A+ is provided to switch the antenna from the receiver input to the transmitter input and to operate the high level transmitter stages.

When the push-to-talk button is released, the following takes place:

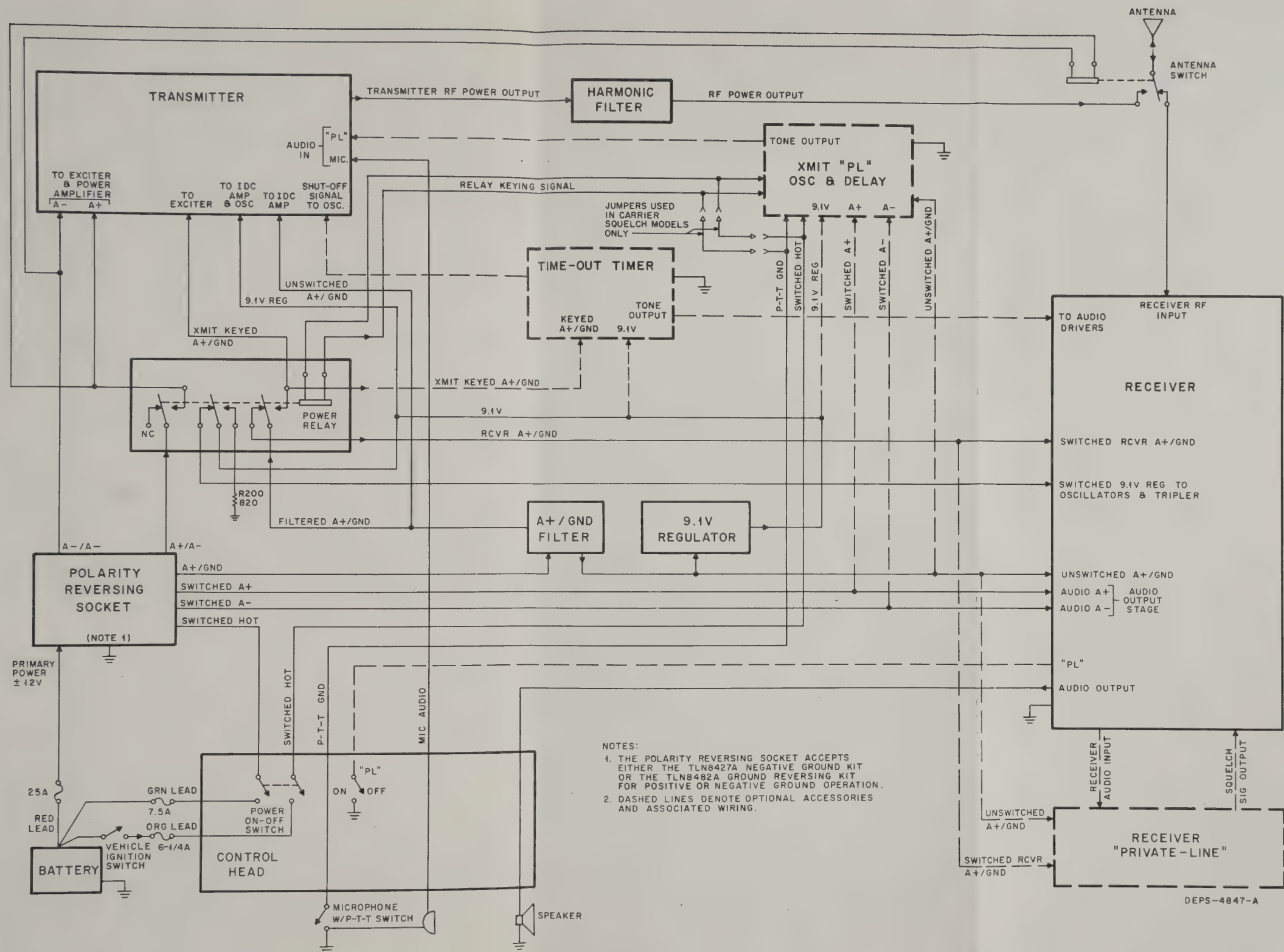


Figure 1.
Functional Block Diagram

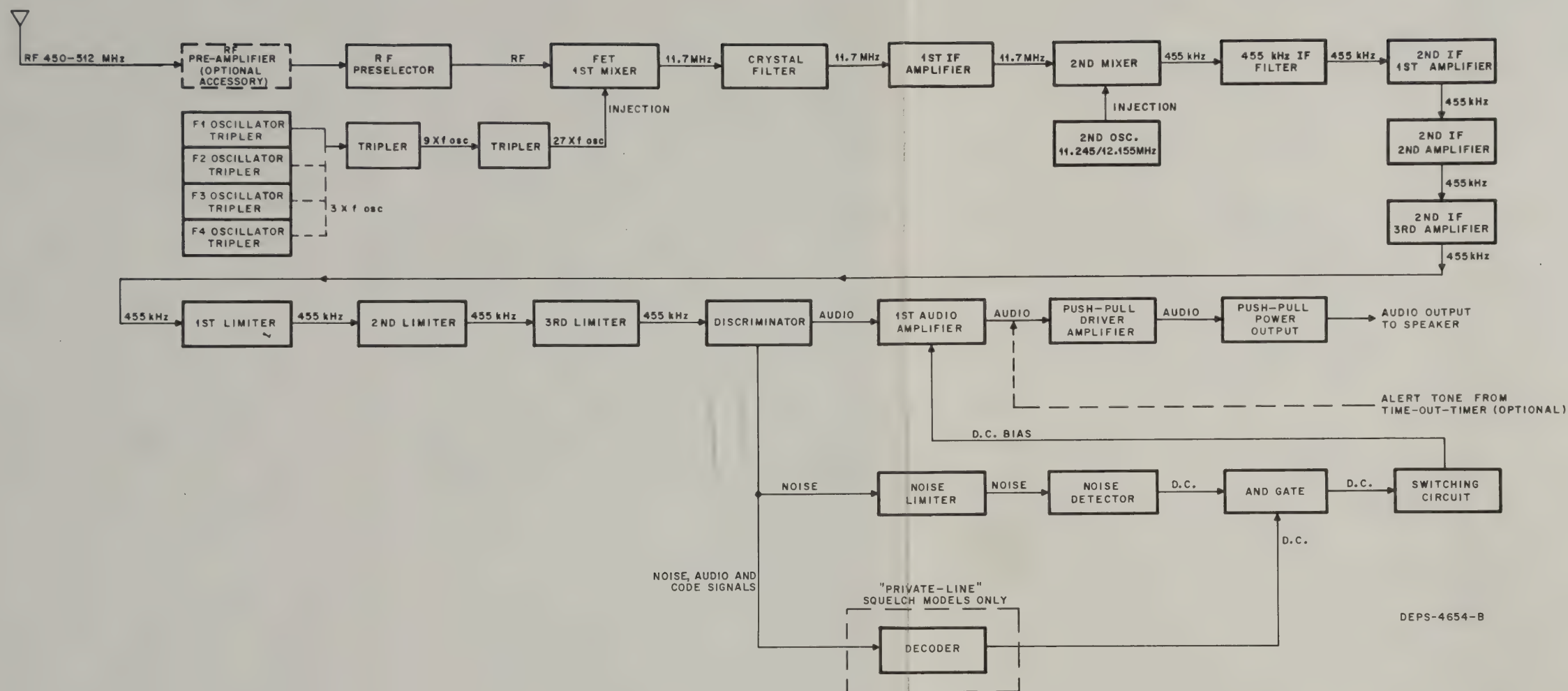


Figure 2.
Receiver Block Diagram

a. Carrier Squelch Radios

(1) The red transmit indicator lamp on the control head goes out.

(2) The power relay opens to remove A+ from all transmitter rf stages. The antenna, filtered A+, and regulated 9.1 V are switched to the receiver.

b. TPL or DPL Coded Squelch Radios

(1) The red transmit indicator lamp on the control head turns off.

(2) TPL systems only -- In this system the controlled A+ voltage to the tone generator is removed which causes a phase reversal of the tone output fed to the modulator. The path to the push-to-talk bridge is opened but a delay circuit keeps the transmitter on for approximately 150 milliseconds after release of the push-to-talk switch. During this time, the reverse burst is transmitted which damps the vibration of the "Vibrasponder" resonant reed in the listening receiver and returns it to the squelch condition. After the 150 millisecond delay, the power relay opens to remove all voltages and the radio reverts to receive operation.

(3) DPL systems only -- In this system the transmit code enable is removed from the DPL encoder; however, a delay circuit keeps the transmitter on for approximately 180 milliseconds after release of the push-to-talk switch. During this time, the DPL encoder generates a turn-off which is transmitted. The turn-off code is decoded in the listening receiver and returns it to the squelch condition. After the 180 millisecond delay, power is removed from the transmitter and the radio reverts to receive operation.

2. RECEIVER

The receiver is a completely transistorized double-conversion superheterodyne type. It receives FM signals on one (or up to four) fixed crystal-controlled frequencies.

The multi-frequency receiver is the same as the one frequency model except for the addition of three oscillator circuits. Only one frequency can be received at a time. A switch on the control head selects the desired operating frequency on multi-frequency models. The frequency selector switch completes a path to ground for the corresponding transmitter and receiver oscillators thus allowing them to operate. (Unusual receive-transmit combinations, such as two frequency transmit and three frequency receive, require minor circuit modifications.) The modifications are covered in the Service Aids Section of this manual.

a. RF Preselector

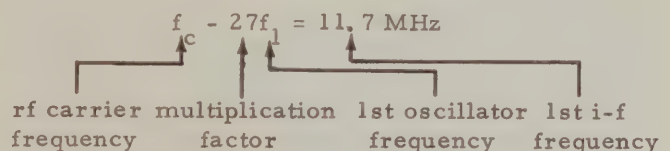
The rf signal received at the antenna is routed to the preselector via the antenna relay. The preselector has a flat noise bandwidth and a steep skirt response to provide rapid attenuation of signals outside the accepted bandwidth. Capacitive and magnetic coupling are used to couple the signal through the resonant cavity apertures. The preselector contains six low-loss, highly selective, helical resonator cavities (L1 through L6).

b. Oscillator-Multiplier

The oscillator circuit(s) consist of either one or four (multi-frequency models) Colpitts oscillators and may contain up to four temperature-compensated crystal resonators. The oscillator output is fed to a two-coil filter (L9 and L10) which is tuned to pass only the third harmonic. The injection signal then passes through two successive tripler stages which raise the frequency to 27 times the crystal frequency. Coils L11, L12 and L13 are tuned to the ninth crystal harmonic. L14, L15, and L16 (high-Q aperture tuned coils) are tuned to 27 times the crystal frequency. The injection output is then applied to the source of the FET 1st mixer.

c. First Mixer

Signals from the rf preselector and multiplier circuits are applied to the first mixer, a field effect transistor (Q1). The injection frequency is below (low side injection) the rf carrier frequency. The mixer heterodynes the two signals to produce the first intermediate frequency (1st i-f) of 11.7 MHz.



d. First Intermediate Frequency (High IF) and Second Mixer

The output from the 1st mixer (Q1) is coupled through a monolithic crystal filter to a common emitter high i-f amplifier circuit (Q5). The crystal filter provides close-in selectivity at alternate and adjacent channels.

The output of the i-f amplifier is coupled to the base of the second mixer (Q6) through a highly selective triple-tuned network consisting of T2, L7 and L8.

The crystal-controlled 2nd oscillator operates below the 1st i-f at 11,245 MHz except in the case where the receiver is tuned near harmonics of this frequency. To avoid interference from these harmonics a crystal which oscillates above the 1st i-f at 12,155 MHz is used.

The 12,155 MHz crystal is 455 kHz above the 11,7 MHz 1st i-f and the 11,245 MHz crystal is 455 kHz below it. The output of the 2nd mixer is the difference between the 2nd local oscillator and the 11,7 MHz i-f. This resulting 2nd i-f frequency is 455 kHz.

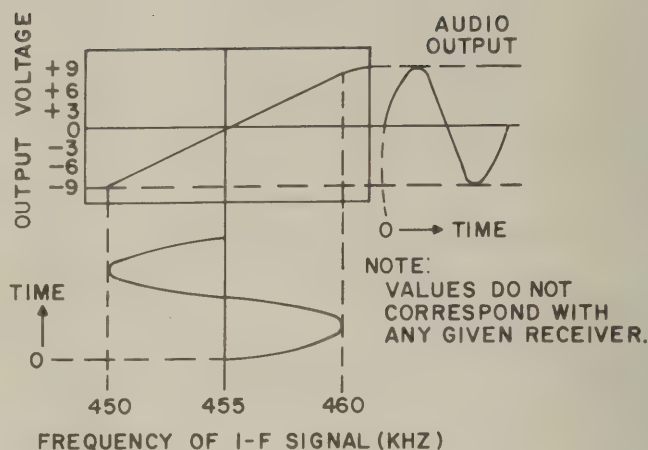
e. Second IF

A "Permakay" 2nd IF Filter precedes the second i-f amplifier circuit. The filter sections are permanently sealed in polyesterstyrene and the filter is unconditionally guaranteed for the life of the receiver, provided the seal is not broken and the housing is not tampered with. This filter is the major factor in determining the bandwidth and selectivity of the receiver. It greatly attenuates the signal outside the pre-determined bandpass. Three i-f amplifier stages follow the 455 kHz filter to saturate the limiter.

f. Limiter Stage

The three limiter stages are 455 kHz amplifiers arranged so that an increase in input signal produces no change in the amplitude of the output signal. Because of more than adequate receiver gain, the limiters are in full saturation at all times, that is, with weak or strong signals or noise only.

When a signal is applied to the N-P-N first limiter, the base is driven negative with respect to the emitter when the signal is negative. This places a reverse bias at the emitter-base junction causing the collector current to drop to zero. When the signal is positive, the base-emitter junction becomes forward biased thus increasing the collector current to its maximum value. Thus, the collector current is driven to both cut-off and maximum. Operation of the second limiter is essentially the same except that the signal undergoes a phase reversal in the first limiter and the P-N-P transistor performs the same functions with its input signal of opposite polarity. The output of the limiters is a signal of constant amplitude.



AEPS-1795-0

Figure 3.

Typical Discriminator Response

g. Discriminator

The discriminator used is a phase discriminator, that is, the operation is dependent upon a 90° phase shift which occurs at resonance between the primary and secondary voltages of the tuned transformer.

The discriminator recovers the audio from the 455 kHz i-f signal. A typical discriminator response curve is shown in Figure 3.

The i-f signal varies in frequency at the audio rate. This is shown below the curve. The corresponding audio output is drawn to the right of the curve.

An emitter follower (Q309) is used to prevent possible loading of the discriminator by the audio and squelch circuits.

h. Noise-Actuated Squelch Circuit

The purpose of the squelch circuit is to eliminate disturbing noise which would otherwise be heard at the speaker during intervals between received messages.

The noise-actuated squelch circuit consists of a noise limiter (Q345), noise detector (Q346), and dc control stage or audio switch (Q347).

In the absence of a received rf carrier (SQUELCH control at threshold), noise from the

discriminator is amplified by the noise amplifier limiter. This noise voltage is rectified in the form of drawing more or less current in the noise detector stage. More current is drawn when the receiver is fully squelched (SQUELCH control fully clockwise); less current is drawn when the receiver is in the unsquelched condition.

When the noise detector is drawing heavy current, a less positive voltage is developed at the emitter of the detector. This causes a forward bias to be applied to the switching transistor which, in turn, reverse biases the first audio amplifier stage cutting off that stage. Therefore, the following audio stages do not receive signals and the speaker is quiet.

When an on-frequency signal is received, the noise reaching the squelch circuit diminishes so that there is little or no output from the noise detector. As a result, the audio switch is cut off and the audio amplifier is biased normally. Under these conditions, the incoming signals reach the speaker.

i. Tone-Actuated Squelch Circuit in "Private-Line" Tone-Coded Squelch Models

As shipped from the factory, "Private-Line" receivers incorporate a tone actuated "Private-Line" squelch circuit that works in conjunction with the noise actuated carrier squelch circuit. In this mode the "Private-Line" squelch sensitivity is affected by the carrier squelch sensitivity. Thus the "Private-Line" squelch sensitivity is variable with the setting of squelch control. If desired, the radio can be wired so that the "Private-Line" squelch sensitivity is independent of the carrier squelch control. To accomplish this, insert jumper JU702 and remove jumper JU703. In normal operation, the receiver audio is activated only when both of the following conditions occur: (1) an on-frequency rf signal must be received to disable the carrier squelch circuit and (2) the rf signal must be FM modulated with the proper sub-audible tone frequency to activate the "Private-Line" tone-coded squelch decoder circuit.

The "Private-Line" (PL) decoder circuit consists of a low-pass filter network, a high-gain amplifier, an amplifier/clipper, a "Vibrasponder" driver stage, a "Vibrasponder" resonant reed, an output amplifier, a detector, an output switch stage, and a noise gate switch.

The output from the emitter follower is connected to the low-pass filter network, (L751, C752, C753, C754) which passes frequencies below 300 Hz. The low-frequency signals (PL tone) are amplified

by Q751 and coupled to the input of the amplifier/clipper Q752. The output of the amplifier/clipper is applied to the "Vibrasponder" driver stage to drive the resonant reed.

The "Vibrasponder" resonant reed is a highly selective, contactless, electro-mechanical device which is permanently tuned and sealed at the factory. The reed is energized only when a tone of the precise frequency appears in the discriminator output. When this occurs, the vibrating reed produces a sinusoidal output which is amplified and detected. The detected output is applied to the output switching transistor (Q756) which provides a dc voltage for biasing the switching transistor (Q347). The noise (carrier) squelch detector (Q346) also provides dc voltage for biasing Q347. If both of the voltages exceed a certain level (approximately 10 V), the audio switching transistor (Q347) base-emitter junction will be back-biased and the first audio amplifier (Q340) will conduct.

The PL low-pass filter is paralleled by a high-pass circuit to prevent erratic operation of the "Vibrasponder" reed because of noise. The high-pass filter passes some higher frequency noise components which tend to drive the amplifier/clipper into limiting. The resulting saturation of Q751 effectively reduces the PL squelch sensitivity.

When the proper tone signal is received and the audio pre-driver stage is turned on, the high-pass path is shorted to ground through the noise switch (Q757). With the high frequency noise removed, the PL squelch sensitivity is at maximum to insure an unsquelched receive condition until the end of the transmission.

Since both a carrier and proper PL tone must be present in the receiver to activate the receiver audio, the carrier squelch control affects the PL sensitivity (with the jumper circuit configuration on radio sets as shipped from the factory). For optimum sensitivity, use the procedure outlined in the INSTALLATION AND OPERATION section of this manual.

j. "Digital Private-Line" Binary-Coded Squelch Models

"Digital Private-Line" binary-coded squelch is a system that utilizes a binary code to unsquelch the radio set. The basic operation of this squelch is described in a separate Motorola instruction section, 68P81106E83. This instruction section together with the schematic diagram provides theory and maintenance information for this type of squelch.

k. Audio Circuit

Audio signals from the discriminator are coupled to the first audio stage through the VOLUME control and a high pass filter. The VOLUME control varies the signal level applied to the base of the first audio amplifier. The filter effectively blocks signals below 300 Hz (on "Private-Line" models, additional filtering is provided to more completely suppress the PL tone) and pass the desired audio range of 300-3000 Hz.

The first audio amplifier is reverse biased when the radio set is squelched. The emitter voltage drops below the base voltage to produce the reverse bias condition. In the normal receive condition, the first audio amplifier is forward biased and the output signals are applied to the driver. The drivers are connected in an emitter coupled phase splitter configuration. The capacitor in the base of one driver transistor provides the 6 dB per octave de-emphasis characteristic from 300 to 3000 Hz. As the frequency of the signal increases, the impedance across the capacitor decreases and the resultant signal amplitude decreases. The audio output from the drivers is transformer coupled to push-pull output amplifiers. The output stage provides a 5-watt output to a 3-ohm speaker with less than 5% distortion. Response is within +2, -8 dB of the 6 dB per octave de-emphasis characteristic from 300 to 3000 Hz.

3. TRANSMITTER

a. General

This solid-state transmitter is directly frequency-modulated for crystal controlled operation in the 450-512 MHz range. It consists of an oscillator-modulator, several amplification and frequency multiplication stages and selective filtering to process a carrier signal which is 27 times the fundamental crystal frequency. The Transmitter Block Diagram (Figure 4) shows the stage-by-stage signal flow and operating frequencies.

b. Microphone and Preamplifier Circuit

The Motorola dynamic microphone contains a transistorized preamplifier. The microphone cartridge and preamplifier acts as a variable voltage generator producing an output voltage which varies with both frequency and intensity as the sound waves strike the diaphragm.

c. Deviation Limiting Circuit

(1) A-Suffix Main Board Models

The output waveform from the microphone is connected to the deviation limiting circuit. The deviation limiting circuit consists of components for pre-emphasizing, amplifying and limiting the input waveform.

C196, R196, C191, and the input impedance of the IDC Amplifier comprise an audio shaping network which yields a 6 dB per octave pre-emphasis response below 3 kHz and a flat response above 3 kHz. After pre-emphasis, the audio signal is amplified by Q101 and Q102. Negative feedback (R186 and R187) is used to maintain constant gain and low audio distortion. Amplitude peaks are clipped when Q102 is driven to saturation (fully on) or cut-off (fully off). The peak-to-peak amplitude is limited to 9.1 volts by Zener diode CR181.

The pre-emphasized, amplified and clipped microphone audio passes through the splatter filter (L180, C188, C194, and C195) to the base of the emitter follower (Q103). (The PL tone is injected at this point on PL models.) The emitter follower isolates the modulator load from the splatter filter thus insuring proper splatter filter response. An IDC adjustment potentiometer is provided for each oscillator (R101, R102, R103, R104). It is necessary to set the deviation for each channel in a direct FM system because the modulator sensitivity is related to the individual oscillator characteristics.

(2) B-Suffix Main Board Models

Refer to exciter schematic diagram EEPS-4699-F. Microphone audio is applied to the deviation limiting circuit, which provides pre-emphasis, amplification, and audio limiting.

Coupling capacitor C182 and the input resistance of the audio amplifier stage (Q100) provide 6 dB per octave pre-emphasis.

The audio signal from the microphone is amplified by Q100 and is applied to the "IDC" limiter. The IDC limiter consists of complementary-connected transistors Q101 and Q102, and their associated components. Capacitor C185, with the base and emitter resistances of Q101, and C186, with the base and emitter resistances of Q102, form a high-pass filter with a cut-off frequency of about 200 Hz. The single-ended output from the collectors of Q101 and Q102 is

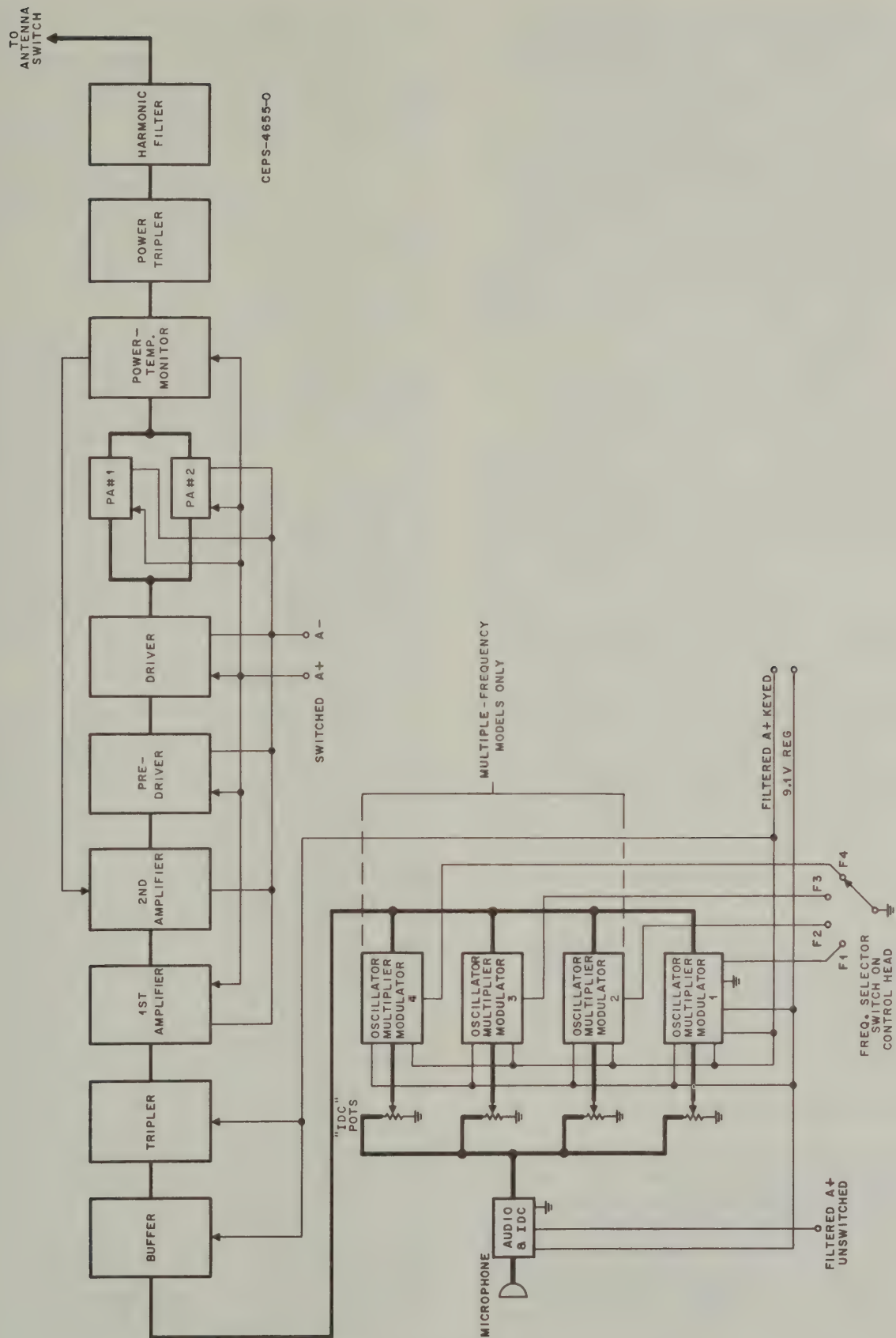


Figure 4. Transmitter Block Diagram

applied to the input of emitter follower Q103. Emitter-to-base and collector-to-base feedback paths are provided to ensure a symmetrical input waveform at the input of the emitter follower.

The limited audio signal passes through splatter filter L180 and C188 to the base of Q103. The PL tone is also applied to the base of Q103 in PL model radio sets. The emitter follower isolates the modulator load from the splatter filter to ensure proper splatter filter response. An IDC adjustment potentiometer is provided for each oscillator. It is necessary to set the deviation for each channel in a direct FM system because the modulator sensitivity is related to the individual oscillator characteristics.

d. Modulator-Oscillator-Multiplier Stage

The combination modulator-oscillator-multiplier stage generates a modulated rf signal at three times the fundamental crystal frequency. The direct frequency modulator consists of the parallel combination of a varactor and warping coil connected in series with the crystal. A change in capacitance seen at the crystal terminals will cause the crystal to vary its resonant frequency in proportion to the capacitance change. The audio voltage from the audio and IDC circuitry is applied to the varactor to cause a change in capacitance; this variation in turn causes the frequency to change at the same audio rate. The double-tuned circuit, L102 and L103 at the output of the oscillator transistor(s), tunes to the desired third harmonic of the crystal.

NOTE

Because the frequency adjustment coils (L101, L107, L108, L109) and the modulator circuitry are combined, THE TRANSMITTER FREQUENCY MUST BE PROPERLY ADJUSTED BEFORE SETTING THE TRANSMITTER DEVIATION WITH THE "IDC" CONTROL. Refer to the transmitter alignment procedure for details.

e. Multiplier and Amplifier

From the modulator, the rf signal is amplified by Q105 and applied to Q106, which is a class C multiplier that triples the signal frequency. The tripler output is next amplified by Q107. All of the rf circuitry up to this point is contained in the exciter. The rf output frequency of the exciter is 150.0 to 170.7 MHz, with a nominal power output of 500 milliwatts.

f. Power Amplifier

The power amplifier (Q108, Q109 and Q110) consists of three class C amplifiers and two final amplifiers (Q111, Q112) arranged in a push-pull configuration. The stages are coupled by low Q broadband capacitive matching networks such that only two tuning elements (C102, C103) are required in the entire power amplifier circuit. The power output from the amplifier chain is nominally 50 watts at approximately 150 MHz.

g. Power Tripler

The 150 MHz output from the power amplifier is fed through a broadband matching network to the power varactor CR640. The non-linear characteristic of the varactor causes the rf input signal to be frequency doubled (to approximately 300 MHz). The 300 MHz signal is then passed through the non-linear varactor a second time during which the 300 MHz signal and the 150 MHz input signal are heterodyned to produce a 450-512 MHz signal, the desired carrier frequency. The power tripler output is coupled through the output matching network (L642, C104, L643, and C642) to the bandpass harmonic filter and the antenna switch.

h. Power-Temperature Monitor

A series regulator (Q113) is the collector feed of the 2nd amplifier and it protects against harmful conditions which cause power amplifier overdisipation such as antenna mismatch, high battery voltage or excessively high temperatures.

A directional coupler is used to sense forward power levels. By sensing the forward power, the output level can be stabilized within safe, controlled levels of transistor dissipation. The forward power level is detected by CR670 and applied to trigger amplifier Q115. The trigger level of Q115 is determined by potentiometer R105. Once Q115 is triggered, dc amplifiers Q116 and Q117 are turned on. Normally Q118 and Q113 are saturated. However, when Q117 turns on, Q118 and Q113 drop out of saturation, thus reducing the dc voltage supplied to rf amplifier Q108. RF power output from Q108 is reduced when its dc supply voltage falls. RF drive to the power output stages and, consequently, rf power output are thereby reduced.

Thermistor RT670 monitors the varactor temperature and reduces rf drive to the power tripler to prevent varactor overdissipation under conditions of high ambient temperatures and excessively long transmitter keying. Under these

conditions, communications can be maintained at a reduced power level. R685, R686 and RT670 base bias Q115 at high temperatures thus causing a reduced A+ voltage to the 2nd amplifier. Short circuit protection for the 2nd amplifier supply line is achieved by current limiting Q118 with CR673, CR674 and R689.

i. "Private-Line" Tone Generator

This tone generator consists of a transistorized two-stage oscillator and "reverse burst" switching circuit. The frequency determining element of the oscillator is a Motorola "Vibrasender" resonant reed (an electro-mechanical equivalent of a parallel-tuned high Q tank circuit). The oscillator operates continuously when the radio set is turned on. The oscillator output is amplified by Q706 and Q707 and is then injected into the transmitter audio - IDC circuit.

The oscillator circuit is made up of Q704, Q705, the "Vibrasender" resonant reed and the bias circuitry. The oscillator tone output is taken from the collector of Q705 or from resistor R724 in the emitter circuit of Q705. The selection of these two paths is determined by diodes CR710 and CR711. When the transmitter is keyed, the push-to-talk lead is connected to the grounded battery terminal. The diode bridge (comprised of CR701, CR702, CR703 and CR704) causes Q701 to turn on. When this happens, CR710 becomes reverse biased and CR709 is forward biased through R728, R730 and R731. The tone oscillator output is now taken from R724. When the push-to-talk button is released, Q701 is turned off and CR710 is now forward biased through R725, and R729. Diode CR709 becomes reverse biased and the tone output is now taken from the collector of Q705. The 180° phase shift between the two tone paths gives a "reverse burst" of tone just after the push-to-talk button is released. This tone prevents "squelch tail" from occurring in the receiver by quickly damping the "Vibrasponder" resonant reed. Even though the push-to-talk button is released, the transmitter remains "on" for approximately 150 milliseconds so that the "reverse burst" of tone may be transmitted. This delay is accomplished by Q702 and Q703 which comprise the "reverse burst" switching circuitry. When the transmitter is keyed, Q701 and Q703 are immediately turned on. Q703 supplies current to the transmit/receive relay. When the push-to-talk button is released, Q701 and Q702 are turned off but Q702 turns on again after capacitor C701 is discharged through R705. It should be noted that during the discharge time (approximately 150 milliseconds) Q702 is off and Q703 is on. Finally

as Q702 is turned on, Q703 is turned off. This action removes the voltage from the relay which turns off the transmitter.

j. "Digital Private-Line" Encoder

The encoder is contained in an integrated circuit which generates a 23-bit code word during the transmit cycle and a turn-off code for approximately 180 milliseconds after PTT. These signals are applied to the transmitter audio-IDC circuit. For complete description refer to the schematic diagram and separate instruction section 68P81106E83.

4. RECEIVER PREAMPLIFIER (OPTIONAL)

The preamplifier is a single stage grounded gate FET (field effect transistor) rf amplifier which connects between the antenna switch and receiver rf deck. It improves receiver sensitivity 6 dB from the specified receiver 20 dB quieting sensitivity of .5 microvolt.

The signal from the antenna is coupled directly into the input tuned-line of the preamplifier. This tuned-line passes the desired signal and matches the relatively low FET input impedance to the 50-ohm input line. The signal is capacitively coupled to the source terminal of the FET where it is amplified and then capacitively coupled to the output tuned-line. The output tuned-line is a high Q tank circuit. It passes the desired signal and matches the relatively high FET output impedance to the 50-ohm output line.

5. GROUND REVERSING KIT (OPTIONAL)

a. Description

These kits, available on special request adapt "Mocom • 70" radio sets to vehicles with either negative or positive ground electrical systems.

The unit consists of a converter circuit mounted in a compact housing with a plug for insertion into a mating receptacle located in the radio set. Rotating the unit 180° and reinserting it into the receptacle adapts the radio set for the opposite input polarity. The two input polarities are marked on the unit at opposite ends and an arrow on the polarity plug plate identifies the orientation of the unit.

b. General Circuit Operation
(Refer to Schematic Diagram)

When the unit is inserted in the power receptacle in the negative ground position, input polarity to the converter circuit is such that it does not operate. Wiring of the unit connects the dc input directly to the radio set with the proper polarity.

When the ground reversing kit is positioned for positive ground operation, a multivibrator switching circuit feeds the input current into the primary side of a toroid transformer. To produce 12 volts referenced to the chassis, A+ with respect to ground, the output from the transformer secondary (approximately 15 volts) is rectified, filtered and referenced to the battery positive terminal, which is the radio chassis. A limiter circuit in the output of the unit prevents damage to the switching transistors under a shorted output condition.

DC starting is provided by resistor R202, which feeds current from the positive input through the base-drive windings of the transformer to the base of the switching transistors. Reverse polarity protection is provided by series diode CR202, in the primary circuit negative-return lead.

c. Starting and Running

When voltage is applied to the converter, assume that Q201 conducts more than the other switching transistor because of a small imbalance in the circuit. The resulting increase in voltage across the primary of the transformer induces a voltage in the feedback winding of a polarity that will cause transistor Q201 to be driven into saturation and Q202 to be reverse biased and driven into cutoff. As the transformer saturates, causing no change in the flux density, the drive to the base of Q201 is reduced and the collector current begins to decrease. This causes a change in the flux in the opposite direction that drives Q201 into cutoff and forward biases Q202, turning it on. Q202 then operates as Q201 did in the initial half cycle.

d. Output Circuit

The output limiter circuit uses Q204 as a short-circuit detector to control the base drive of a saturated switching transistor (Q203) connected in series with the positive output lead. If the output is short circuited, the output voltage falls and removes the drive voltage to the short-circuit detector (Q204). As Q204 turns off, the base drive to Q203 is removed forcing it into cutoff.

This causes the 680-ohm resistor (R205), connected from the collector to the emitter of Q203, to appear as the load so that the converter operates correctly with a 680-ohm load instead of a short circuit load.

e. Conversion of Negative Ground Only Radio Sets to Positive or Negative Ground Operation

Remove existing plug P201 (TLN8427A Negative Ground Kit) from the radio and replace it with the TLN8482A Ground Reversing Kit. Insert this plug-in unit so that the arrow on the polarity plug plate points to the same ground polarity on the kit as that of the vehicle electrical system.

6. TIME-OUT TIMER (OPTIONAL)

(Refer to Schematic Diagram)

The time-out timer circuitry (mounted on the polarity plug plate) is used to turn off the transmitter and activate the receiver audio to generate an alert tone if the radio set is keyed continuously for more than one minute.

Once the timer has timed out, it may be reset for another minute by simply unkeying and then keying the transmitter.

When the radio set is in the receive condition, keyed A+ with respect to ground is removed, therefore, diode CR251 is reverse biased and transistor Q251 is saturated by the bias applied to its base via resistors R253 and R254. When the transmitter is keyed, the keyed A+ with respect to ground forward biases diode CR251 and reverse biases the base emitter junction of Q251, turning it off. With Q251 cut-off, capacitor C251 starts to discharge through resistor R255. During this discharge time the emitter of transistor Q252 is held at approximately 2.7 volts by the combination of resistors R256 and R257. This emitter voltage holds Q252 at cutoff. After a one minute period, the voltage across capacitor C251 drops to approximately 1.6 volts. At this time, diode CR252 becomes forward biased turning on transistor Q252 which supplies sufficient gate current to fire the silicon controlled rectifier (SCR) SCR251. When the SCR conducts, the base-collector junction of transistor Q253, which serves as a diode, becomes forward biased causing transistor Q250 to shut off. On radio sets equipped with a time-out timer, Q250, normally acts as an emitter follower and is the A+ voltage source for the transmitter oscillator-modulator. Thus, when Q250 is shut off, the transmitter is shut off.

When the transmit-receive relay opens, transmitter keyed A+/GND drops to zero thereby permitting SCR251 to reset.

When the SCR conducts, the unijunction transistor (Q255) oscillates at an audio frequency. The output from oscillator Q255 is fed through capacitor C255 and R252 to the audio drivers in the receiver as the alert tone. The amplitude of the alert tone may be changed by changing the value of R252 (at no time should R252 be less than 47K ohms). The table on the schematic diagram shows the amplitude variations in speaker output, for different selected values of R252. Biasing voltages for these stages are supplied via resistor R251 and diode CR253 when the keyed A+ with respect to ground is applied.

7. AUTOMATIC PILOT LIGHT DIMMER CIRCUIT

(Refer to applicable Schematic Diagram)

The pilot light dimmer circuit automatically controls the brilliance of the green (receive) pilot light mounted on the control head. In bright daylight, the light glows brightest to insure visibility. The light becomes progressively dimmer to reduce excessive glare as daylight

changes to darkness. External illumination is sampled through a window in the lower portion of the control head and acts upon a light detecting resistor which is mounted behind the window.

When the radio is turned on, transistor Q501 conducts. Its collector current flows through the green pilot light, DS501. The light detecting resistor (LDR) R513, which is part of the base biasing network for Q501, controls the base current flowing into the transistor. Consequently, the current passing through the green pilot light is inversely related to the resistance of R513 (LDR).

The resistance of the LDR is controlled by the amount of light striking it (the resistance decreases as the light intensity increases and vice versa). During daylight operation (LDR resistance low), the collector current of Q501 is high and the light glows brightly. During night time operation (LDR resistance high), the collector current of Q501 is low and the light glows dimly.

The diode bridge (comprised of CR501, CR502, CR503, and CR504) is a polarity switching network which permits dimmer circuit operation in both positive and negative ground systems.

MAINTENANCE

1. RECOMMENDED TEST EQUIPMENT

All of the recommended test equipment for aligning and testing the radio set is listed in the TABLE OF RECOMMENDED TEST EQUIPMENT. The listed items or their equivalent should be used.

2. TRANSMITTER SERVICING

a. Alignment Procedure

Instructions for aligning the transmitter are provided in the Transmitter Alignment Procedure of this manual. Refer to these instructions for all information pertaining to transmitter tuning.

b. Metering the Transmitter

A 12-pin metering receptacle for connecting a Motorola S1056B to S1059B Series Portable Test Set is located in the exciter circuit on the main

radio board. A Motorola Model SKN6012B Metering Cable must be used to connect the portable test set to the metering socket. Typical meter readings are given in the Transmitter Alignment Procedure. If meter readings differ greatly from those in the table, check the transmitter for defective components or improper alignment.

c. Power Output

Connect a wattmeter at the antenna receptacle on the front panel of the radio set and take a power reading. If rated power output is not obtained (25 watts) proceed with meter readings.

d. Meter Readings

Connect the portable test set to the transmitter metering socket and set the function selector switch of the test set to the XMTR position. Take readings and compare them with the values tabulated in the Transmitter Alignment Procedure, or preferably, compare them with the set of readings taken the last time the transmitter was serviced.

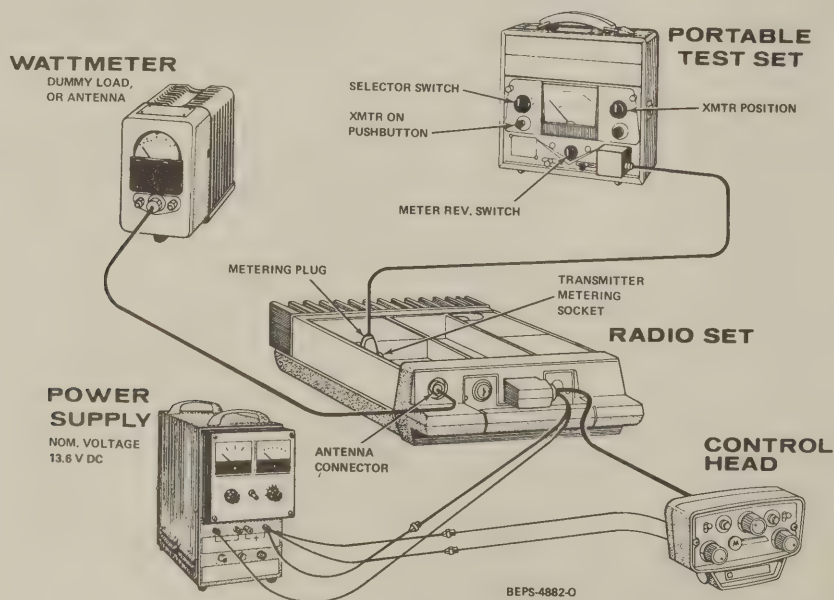


Figure 5.
Exciter and Power Amplifier Test Set-Up

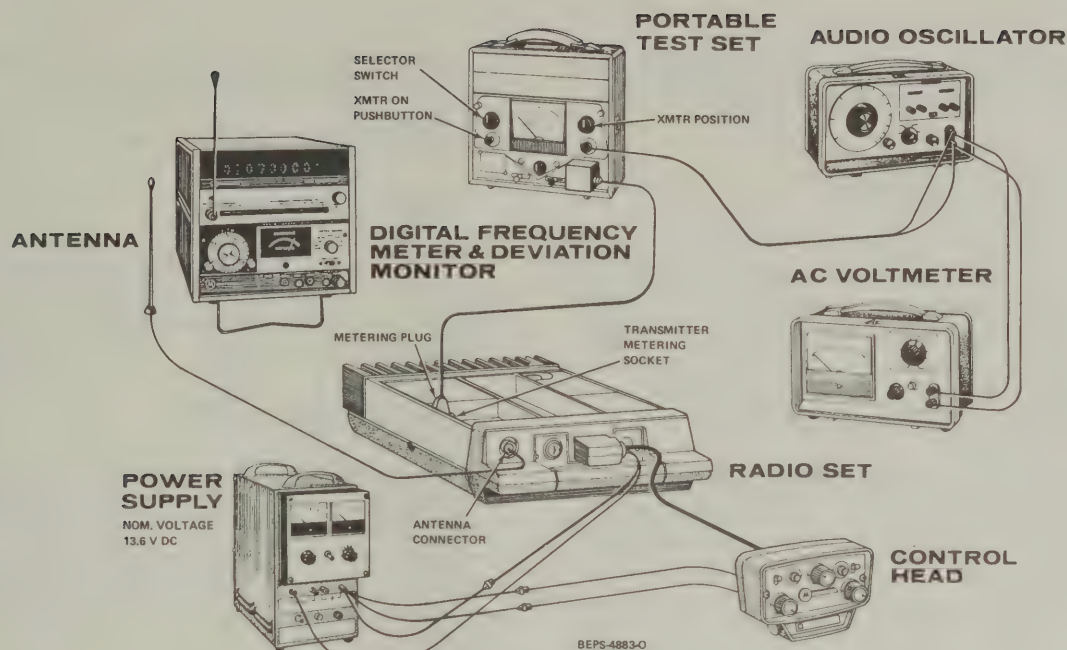


Figure 6.
Frequency, Deviation and Audio
Sensitivity Test Set-Up

e. Troubleshooting the Transmitter

If exciter meter readings are abnormal, the malfunction can be isolated by checking the appropriate stages for proper dc signal voltages. DC readings should be made with either a high impedance voltmeter or a VOM as noted on the schematic diagram, and compared to the readings on the schematic diagram or previous voltage data on the unit. It should be noted that the class C stages Q106, Q110, Q111 and Q112 will show reverse bias on the emitter-base junction. This is normal, due to the self-bias generated by the transmitter when driver is present. Consequently, this can be used as an indication of drive to a particular stage.

The ac signal readings given in TABLE III may be used as a guide to isolating a defective stage. Also, typical transmitter audio and rf waveforms are shown on the schematic. An rf probe and high impedance dc voltmeter can be used for the rf readings. The audio stages will require a sensitive ac voltmeter.

Voltage and resistance checks of the suspected stage in the exciter or power amplifier section should isolate the defective component.

If all meter readings and rf voltages are normal and there is no power output, check all connectors on the harmonic filter and antenna

switch. If necessary, remove the power tripler in the manner illustrated in Figure 12.

Check the varactor diode with a volt-ohm meter to measure the dc resistance in both directions (an electronic voltmeter will not give valid readings in this application). A low impedance should be read in one direction and 5.6k in the other. If 5.6k is measured in both directions, the diode is open. Remove diode as shown in Figure 15 and replace. If a low impedance is read in both directions, remove the diode and check it by itself. If the diode tests good, check all parts in the matching networks for short circuits.

If the ohmmeter readings are correct, use a high impedance dc voltmeter to measure the voltage from diode to ground when the transmitter is keyed. A voltage of approximately -20 V dc should be read. If no voltage is measured, check the input cable and matching network for open circuits or loose connections.

f. Frequency and Audio Sensitivity

Check transmitter frequency and modulation sensitivity. No more than 140 mV rms and no less than 70 mV rms of 1000 Hz audio signal applied (through a capacitor) at the microphone receptacle should be required to produce 3.0 kHz deviation. If the transmitter cannot be "warped" to the proper frequency, check the regulator

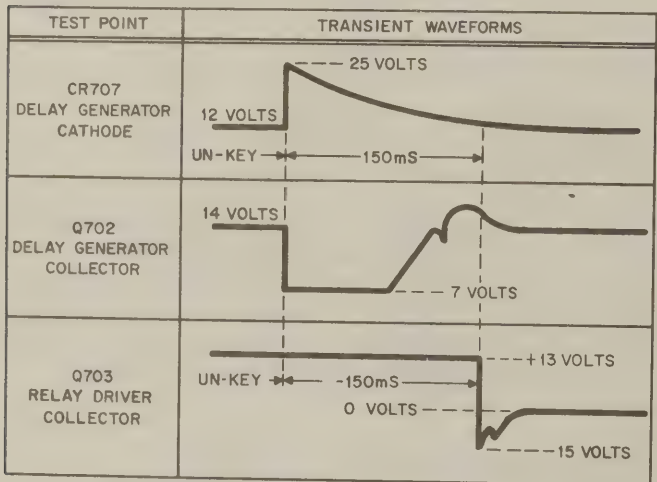
voltage (9.1 V dc). Replace the resonator, varactor diode, or other oscillator components if necessary.

g. "Private-Line" Encoder

If transmitter deviation with PL tone applied is improper, check the tone oscillator and tone amplifier circuits. The typical ac signal levels, given in TABLE I, were measured with a Motorola Transistorized AC Voltmeter. Signal levels may vary widely depending upon the frequency of the "Vibrasender" Resonant Reed.

The phase of the signal at the tone generator output should reverse when the transmitter is keyed and revert to the original condition immediately when unkeyed. The "Vibrasender" Resonant Reed can be checked quickly by plugging it into a Motorola SLN6221A "Private-Line" Tone Generator. If a tone output is generated, the reed is good. Make dc voltage checks and resistance checks to isolate the defective part.

If "squelch tail" noise bursts are heard in listening receivers, check voltages in the "reverse burst" switch circuit of the transmitting station. DC voltages given on the schematic are for the transmitter keyed condition. Figure 7 shows the important transient waveforms which should be seen in the "reverse burst" circuitry when the transmitter is unkeyed.



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Figure 7.

Transients Appearing in "Private-Line" Delay Circuit After the Transmitter is Unkeyed

h. "Digital Private-Line" Code Generation

If transmitter deviation with "Digital Private-Line" binary signals applied is improper, refer to

separate Motorola instruction section 68P81106E83 for information on setting deviation.

3. RECEIVER SERVICING

a. Alignment Procedure

Instructions for aligning the receiver are provided in the Receiver Alignment Procedure of this manual. Refer to these instructions for all information pertaining to receiver tuning.

b. Metering the Receiver

A 12-pin metering receptacle for connecting a Motorola S1056B to S1059B Series Portable Test Set is located near the discriminator transformer on the main radio board. A Motorola Model SKN6012B Metering Cable must be used to connect the portable test set to metering socket.

c. Receiver Sensitivity

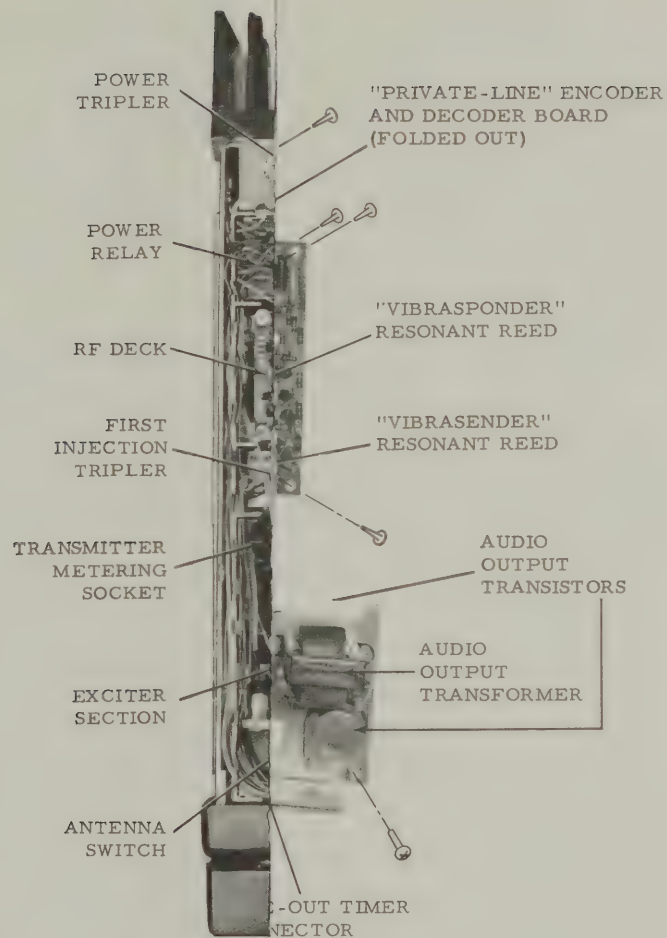
The sensitivity measurement is a relatively simple means for making a very comprehensive check on receiver overall gain distribution and general operating performance. The sensitivity check should be among the first measurements made when a receiver malfunction is suspected.

Receiver sensitivity can be determined by using either the EIA-SINAD method or the 20 dB quieting method. The SINAD method is certainly the better of the two since the use of a modulated carrier gives a check on receiver bandwidth and audio power output; two performance characteristics which the quieting method by and large ignores. Quieting sensitivity, however, is by far the simpler measurement and, consequently, is the measurement generally performed in the field. The procedures for both measurements are given here.

$$(1) \frac{20 \text{ dB Quieting Sensitivity: Specification}}{0.50 \text{ uV or less}} = 0.25 \text{ uV or less with preamplifier}$$

The 20 dB quieting sensitivity of a receiver is the minimum value of unmodulated rf generator voltage which will reduce the receiver noise output by 20 dB (1/10th of the initial noise voltage).

To conduct the test, an rf signal generator must be connected to the receiver antenna input and the receiver audio output terminated in its proper load (3- to 4-ohms) with means provided to measure the audio output level. (Either an audio vtm or a Motorola S1056B to S1059B Series Test Set may be used.)



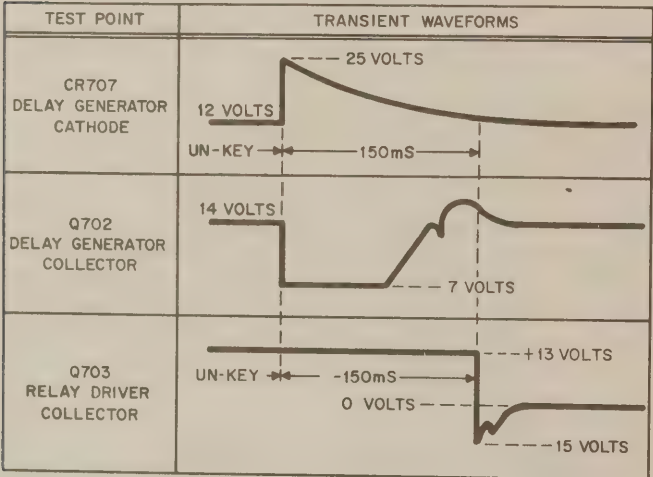
voltage (9.1 V dc). Replace the resonator, varactor diode, or other oscillator components if necessary.

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AEPS-3137-0

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Receiver sensitivity can be determined by using either the EIA-SINAD method or the 20 dB quieting method. The SINAD method is certainly the better of the two since the use of a modulated carrier gives a check on receiver bandwidth and audio power output; two performance characteristics which the quieting method by and large ignores. Quieting sensitivity, however, is by far the simpler measurement and, consequently, is the measurement generally performed in the field. The procedures for both measurements are given here.

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The 20 dB quieting sensitivity of a receiver is the minimum value of unmodulated rf generator voltage which will reduce the receiver noise output by 20 dB (1/10th of the initial noise voltage).

To conduct the test, an rf signal generator must be connected to the receiver antenna input and the receiver audio output terminated in its proper load (3- to 4-ohms) with means provided to measure the audio output level. (Either an audio vtm or a Motorola S1056B to S1059B Series Test Set may be used.)

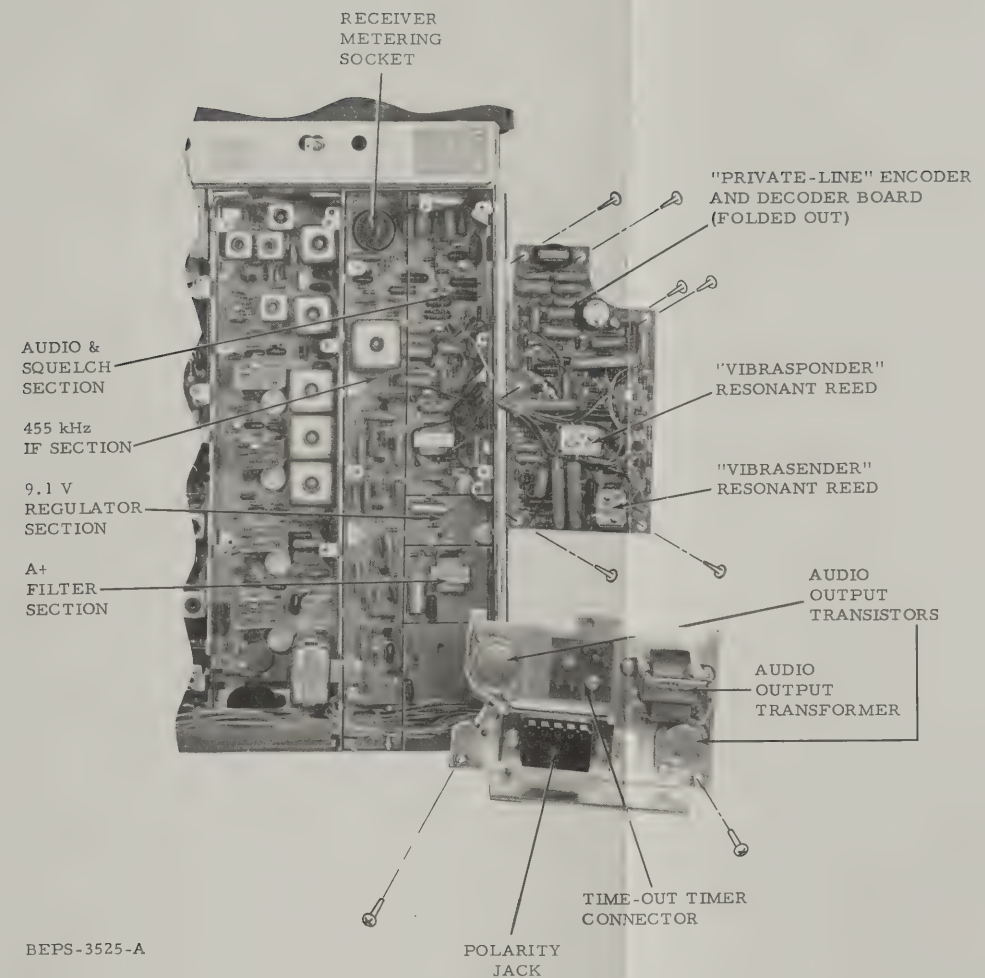
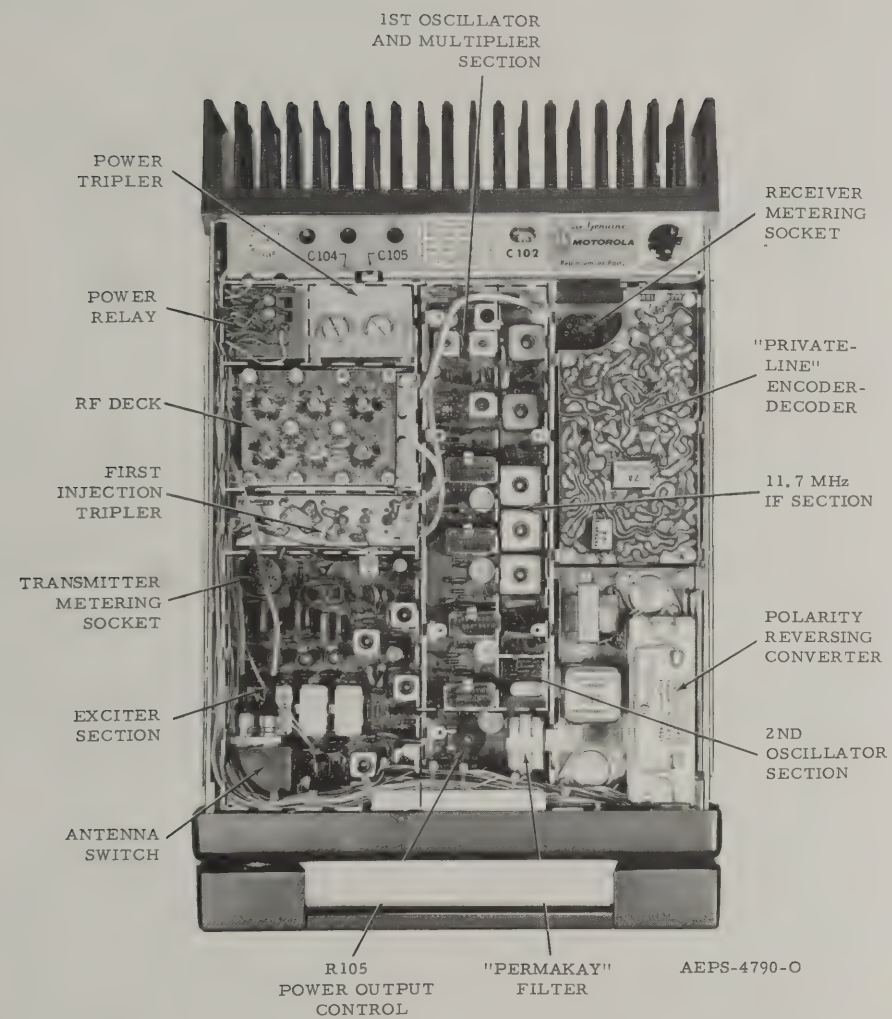


Figure 8.
Radio Set Location Detail

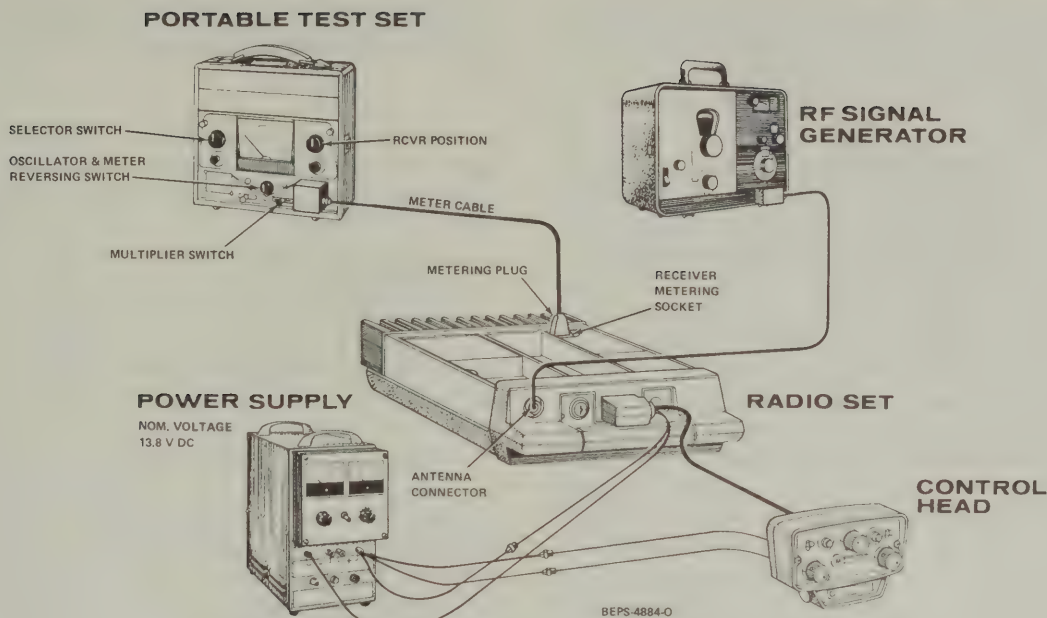


Figure 9.
RF and IF Test Set-Up

With the signal generator initially turned off the carrier frequency, adjust the receiver audio volume control, located on the radio set control head, for 1.0-volt rms audio noise output. (Switch position 11 on the test set.) Note that the squelch control should be turned fully counterclockwise (receiver unsquelched) for this test. On "Private-Line" or "Digital Private-Line" squelch models, the radio must be out of the PL mode.

With the signal generator initially adjusted for a substantial rf input to the receiver (1000 uV), set the generator frequency on the carrier frequency and carefully adjust for discriminator "0" (switch position 4 on the Motorola test set).

The signal generator output is then reduced until the audio output noise level increases to 0.1 V rms. This generator input level is the receiver 20 dB quieting sensitivity.

- (2) 12 dB Sinad Receiver Sensitivity:
Specification = 0.35 uV or less (.18 uV
or less with preamplifier)

The EIA definition for sensitivity of a receiver is the minimum value of the modulated rf generator voltage which will produce at least 50% of the receiver's rated audio power output with a (signal + noise + distortion) to (noise + distortion) ratio (SINAD ratio) of 12 dB.

To conduct the test, an rf signal generator frequency modulated with 1000 Hz at ± 3.0 kHz deviation, must be connected to the receiver antenna input and the receiver audio output terminated in its proper load (3 to 4 ohms) with means provided to measure audio output level and to "eliminate" the 1000-Hz signal.

The most convenient elimination device is a total harmonic audio distortion analyzer, which is also used as the output level indicator; however, any other filter device having an attenuation of at least 40 dB at 1000 Hz and effectively 0 dB attenuation below 900 Hz and above 1100 Hz (up to 3000 Hz or more) can be used in conjunction with a very high impedance audio voltmeter.

The Motorola Model S1067B Audio Oscillator can be used as a band elimination filter and, when used with an audio voltmeter, provides a convenient means for making this measurement.

With the signal generator initially adjusted for a substantial rf input to the receiver (1000 uV), the generator frequency is carefully adjusted for discriminator "0" (switch position 4 on the Motorola Portable Test Set) and the receiver audio VOLUME control, located on the radio set control head, adjusted to provide an indication of the 5 watts rated audio power output (4 volts across 3-ohm load or 4.5 volts across 4-ohm load). Note that the SQUELCH control on the

radio set control head should be turned fully counterclockwise (receiver unsquelched) for this test. On "Private-Line" or "Digital Private-Line" squelch models, the radio must be out of the PL mode.

The signal generator output is then reduced to a low level (.35 uV) and the audio output level noted. The 1000 Hz elimination filter is switched into the circuit and the level difference observed. If the difference is 12 dB (level reduced to one-quarter of the previous voltage) this generator input level is the receiver sensitivity. If the difference is either more or less than 12 dB, the generator attenuator must be adjusted slightly until 12 dB is reached and the new attenuator setting is the sensitivity figure. Should the receiver audio output fall to less than 2.5 watts, with the elimination filter switched out of the circuit, as a result of the test, the generator output must be increased until 2.5 watts is reached and this setting is the receiver sensitivity, even though the SINAD will be greater than 12 dB.

d. Meter Readings

Connect the portable test set to the receiver metering socket and set the function selector switch to the RCVR position. Check the meter readings (with no carrier signal) and compare with the typical readings given in Figure 10.

FIGURE 10.
TYPICAL RECEIVER METER READINGS
WITH NO CARRIER SIGNAL

| Selector Switch Position | Typical Meter Readings in uA | Stage |
|--------------------------|------------------------------|-------------------------------|
| 1 | 0 | Base of 3rd 455 kHz amplifier |
| 3 | 18 | Base of Injection Tripler |
| 4 | 0 | Discriminator Secondary |
| 5 | 25 | Discriminator Primary |
| 6 | 18 | 1st Oscillator Activity |

Set the signal generator on carrier frequency and set the level for a 10-microamp reading in meter position 1. If more than 10.0 uV (5.0 uV with preamp) of carrier signal is required for a 10 uA reading on meter position 1, the receiver gain is low. Check for low mixer injection voltages (paragraph e) and improper receiver gain distribution (paragraph g).

A low meter reading in positions 3 or 6 indicates that the 1st mixer injection is probably low. Refer to paragraph e.

A low meter position 5 reading indicates that the 455 kHz amplifier strip is not operating correctly. Refer to paragraph h.

e. Injection Voltages

With no signal into the receiver, measure the rf voltage on the base of the second mixer (Q6). This voltage should be between 40 and 80 mV.

The best method of determining whether or not the 1st mixer injection signal is adequate is to measure the change in mixer drain-to-source dc current when the resonator is removed. This current is proportional to the voltage drop across R1. Consequently, injection level can be determined by measuring the voltage drop across R1 with a sensitive dc multimeter. With the resonator removed, the typical voltage drop across R1 should be 0.10 V dc. Insertion of the resonator should increase this voltage by at least 0.02 volts.

If either injection voltage is low, check the corresponding oscillator for poor solder connections or defective components. Usually a check of dc voltages in the faulty circuit will pinpoint the source of trouble.

f. Preamplifier Servicing (When Optional Preamplifier is Used)

If a preamplifier malfunction is suspected, the preamplifier should be bypassed and basic receiver operation checked by itself. This is accomplished by disconnecting the rf input plug from the preamplifier and connecting it directly to the rf deck. Connected in this manner, the receiver should meet all specifications and measurements as described for the receiver without a preamplifier. If the receiver is operating normally, remove and repair the preamplifier.

Preamplifier gain can be most easily checked in the following manner using an rf signal generator and a Motorola test set. Set the signal generator on carrier frequency and measure the input level required to produce a reading of 10 uA on meter position 1. Next bypass the preamplifier as described above, retune L1 on the rf deck for maximum indication on meter position 1, and again measure the signal level required to produce 10 uA on meter 1. The difference between the two rf

input levels is equal to the gain of the preamplifier and should be greater than 6 dB and less than 12 dB.

EXAMPLE:

| | |
|-----------------------------|---------------------|
| RF Input for 10 uA on Mtr 1 | |
| with Preamp | = -103 dBm (1.6 uV) |
| RF Input for 10 uA on Mtr 1 | |
| without Preamp | = -96 dBm (3.5 uV) |
| Preamp Gain | = 7 dB |

To remove the preamplifier for servicing, disconnect the input and output rf cables, unsolder the brown-red A+ lead, and remove the two screws which fasten the preamplifier to its mounting bracket.

g. Receiver Gain Distribution + Low Level RF and IF Stages

The simplest method for checking the gain distribution of a receiver is to apply an on-channel rf voltage to the antenna connector while monitoring a selected point in the receiver with an rf voltmeter. The amount of signal necessary to produce a specific reading on the voltmeter gives an indication of the total gain between the antenna connector and the point being monitored. The amount of signal required to produce this reading can then be compared with the values given in TABLE IV and TABLE V. Any significant difference between measured and tabulated values indicates that some circuit between the antenna and the point being monitored is not operating correctly. The faulty circuit can usually be isolated after monitoring several points, whereupon a visual inspection of soldered connectors or a dc voltage check will pinpoint the problem area.

h. High Level 455 kHz Stages

The last three 455 kHz stages should limit receiver noise when no carrier signal is present. Some typical rms noise voltages on the three limiter stages are given in TABLE VI. (All voltages were measured with a Motorola dc multimeter using the rf probe and are referenced to chassis ground.)

The recovered audio noise voltage (as measured at the collector of Q307 with an audio vtm) should be 1.5 V rms. The corresponding audio voltage at the emitter of Q309 (the emitter follower) should measure around 0.53 V rms.

These ac and rf voltage measurements coupled with the dc voltages listed on the schematic

should make troubleshooting this section of the receiver relatively simple. It is possible for the voltage on the base of the 1st 455 kHz limiter (Q304) to be much lower than indicated and still maintain the correct voltage levels at the remaining points. This is an indication of loss of gain in the lower level stages (refer to paragraph g.).

i. Receiver Audio Circuit

Checking the receiver audio section can be done by measuring noise voltages only (i.e., no carrier signal). Set the VOLUME control to maximum and the SQUELCH control fully counter-clockwise (unsquelched). On "Private-Line" tone-coded squelch models, disable PL operation.

Connect an ac voltmeter across the speaker and measure the noise output. At least 3.0 V rms of noise should be measured. (This should correlate to over 5 watts or 4.0 volts of audio output when the unit is receiving a carrier with the standard test modulation.) If the audio output is low, measure the noise voltages at the individual stages to isolate the problem. Typical values of audio noise voltage measured with the Motorola AC Voltmeter are given in TABLE VII.

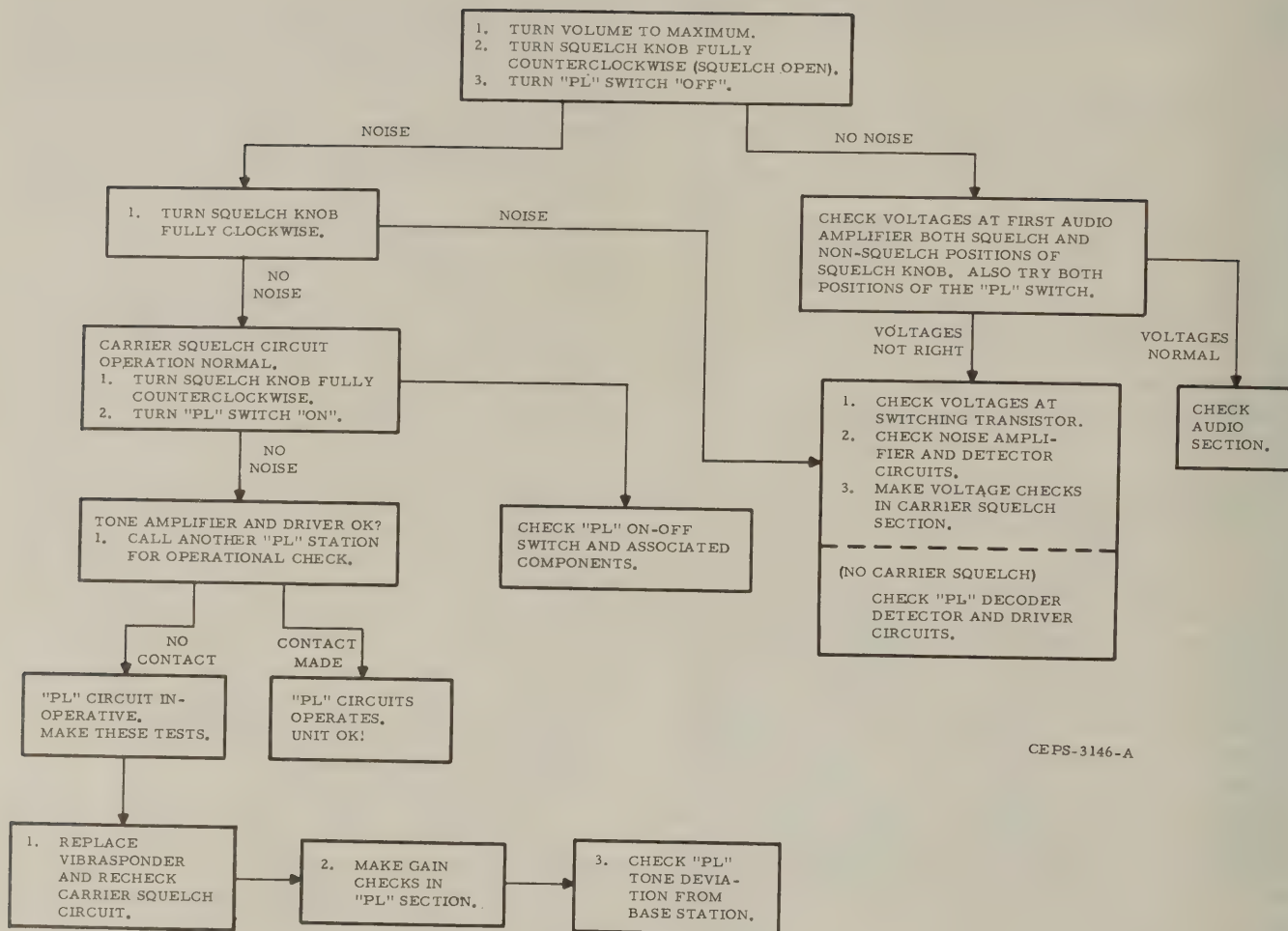
j. Carrier Squelch Circuit

Remove the carrier signal from the antenna input to the unit. If a "Private-Line" tone-coded squelch model is being checked, disable PL operation (checks for "Private-Line" tone-coded squelch circuits are given in the "Private-Line" section). On all sets, set the SQUELCH control fully clockwise to fully squelch the receiver. Typical meter readings are given in TABLE VIII.

Check the dc voltages at the base and emitter of the 1st audio amplifier Q340. Whether this transistor is forward or reverse biased determines the squelch condition of the receiver. When sufficient noise is present, and the radio is fully squelched, as with no carrier, the voltage applied to the emitter of Q340 should be approximately 8.1 volts dc. The voltage should be increased to 10.0 volts dc to unsquelch the radio circuit.

A properly operating squelch circuit should meet the following sensitivity specifications.

(1) Squelch threshold sensitivity: 0.25 uV (0.15 uV with preamplifier) or less. With no signal input, set the SQUELCH control so the noise just quiets (squelch threshold). On "Private-Line" tone-coded squelch models, take the radio out of the PL mode.



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Figure 11.
Receiver "Private-Line" Tone-Coded Squelch Troubleshooting Chart

switch to OFF. Modulate the signal generator with 1000 Hz tone for 3.0 kHz deviation. Set the signal generator output to zero and increase until the tone is heard in the speaker. No more than 0.25 uV should be required to cause the tone.

(2) Full squelch sensitivity: 0.60 uV or less (0.30 uV with preamplifier). Set the SQUELCH control fully clockwise and apply an input signal as in step (1), preceding. No more than 0.60 uV should be required to produce the tone.

k. "Private-Line" Decoder

A general check of the "Private-Line" circuit performance may be conducted as follows:

(1) Receiver PL squelch sensitivity should be 0.25 uV (0.15 uV with preamplifier) or less. Place the radio in the PL mode. Turn the SQUELCH control

fully counterclockwise. Modulate the signal generator with the "Private-Line" tone frequency stamped on the "Vibrasponder" Resonant Reed of the radio set. (This should be done with the Motorola SLN6221A "PL" Tone Generator to insure that the signal is modulated with the exact PL frequency.) Adjust the modulating tone for 0.5 kHz deviation. Set the signal generator output to zero and increase until noise is heard in speaker. No more than 0.25 uV should be required.

If "Private-Line" squelch sensitivity in the receiver is low or the circuit is inoperative, use TABLE II and the troubleshooting chart (Figure 11) to localize the trouble area.

(2) There should be no "squelch tail" (noise burst) at the end of a transmission from other stations in the communications system. A "squelch tail" is indicative of improper operation of the

transmitter PL delay circuitry. Refer to the section on transmitter servicing.

4. "DIGITAL PRIVATE-LINE" CIRCUIT SERVICING

a. General

All theory of operation, test voltages, waveforms, and other servicing information for the "Digital Private-Line" encoder-decoder is included on the schematic diagram. The "Digital Private-Line" encoder-decoder uses a CMOS integrated circuit. CMOS devices should be handled with care. The precautions described in this section should be read carefully before servicing the "Digital Private-Line" encoder-decoder.

b. Handling Precautions for CMOS Integrated Circuits

Many of the integrated circuit devices used in communications equipment are of the CMOS (Complementary Metal Oxide Semiconductor) type. Because of their high open circuit impedance, CMOS ICs are vulnerable to damage from static charges. Care must be taken in handling, shipping, and servicing them and the assemblies in which they are used.

Even though protection devices are provided in CMOS IC inputs, the protection is effective only against overvoltage in the hundreds of volts range such as are encountered in an operating system. In a system, circuit elements distribute static charges and load the CMOS circuits, decreasing the chance of damage. However, CMOS circuits can be damaged by improper handling of the modules even in a system.

TO AVOID DAMAGE TO CIRCUITS, OBSERVE THE FOLLOWING HANDLING, SHIPPING, AND SERVICING PRECAUTIONS:

(1) Prior to and while servicing a circuit module, particularly after moving within the service area, momentarily touch both hands to a bare metal earth grounded surface. This will discharge any static charge which may have accumulated on the person doing the servicing.

(2) Whenever possible avoid touching any electrically conductive parts of the circuit module with your hands.

(3) When servicing a circuit module, avoid carpeted areas, dry environments, and certain

types of clothing (silk, nylon, etc.) because they contribute to static buildup.

(4) All electrically powered test equipment should be grounded. Apply the ground lead from the test equipment to the circuit module before connecting the test probe. Similarly, disconnect the test probe prior to removing the ground lead.

(5) If a circuit module is removed from a system, it is desirable to lay it on a conductive surface (such as a sheet of aluminum foil) which is connected to ground through a resistance of approximately 100k.

WARNING

If the aluminum foil is connected directly to ground, be cautious of possible electrical shock from contacting the foil at the same time as other electrical circuits.

(6) When soldering, be sure the soldering iron is grounded.

(7) Prior to connecting jumpers, replacing circuit components, or touching CMOS pins (if this becomes necessary in the replacement of an integrated circuit device), be sure to discharge any static buildup as described in procedure 1. Since voltage differences can exist across the human body, it is recommended that only one hand be used if it is necessary to touch pins on the CMOS device and associated board wiring.

(8) When replacing a CMOS integrated circuit device, leave the device in its metal rail container or conductive foam until it is to be inserted into the printed circuit module.

(9) All low impedance test equipment (such as pulse generators, etc.) should be connected to CMOS device inputs after power is applied to the CMOS circuitry. Similarly, such low impedance equipment should be disconnected before power is turned off.

(10) Replacement modules shipped separately from the factory will be packaged in a conductive material. Any modules being transported from one area to another should be wrapped in a similar material (aluminum foil may be used). NEVER USE NONCONDUCTIVE MATERIAL for packaging these modules.

c. Performance Tests

If the decoder is operating properly, a 0.25 microvolt rf carrier modulated ± 0.5 kHz with the appropriate digital PL code should unscuech the receiver. This can be checked as follows:

(1) Connect the rf signal generator output to the radio set antenna jack and set the generator output level to minimum.

(2) Modulate the signal generator ± 0.5 kHz with the appropriate "DPL" ("Digital Private-Line") code. The modulating signal can be obtained from a Motorola Model S6413A "Digital Private-Line" Test Set.

(3) Also modulate the signal generator with a 300 to 3000 Hz tone. Total deviation should be ± 4 kHz, including "DPL" code.

(4) Increase the signal generator output level until the receiver unsquelches. No more than 0.25 uV should be needed to unsquelch the receiver.

The encoder should modulate the transmitter rf carrier at least ± 0.5 kHz. The transmitted signal should unsquelch any properly-operating receiver that is equipped with the same "DPL"

code and is operating in the "DPL" mode. After the microphone PTT button is released, the transmitter should remain keyed for about 180 milliseconds and the encoder should produce a turn-off code. No squelch tails should be heard in properly-operating "DPL" receivers. Validity of the "DPL" code and turn-off code can be checked with a Motorola S6413A "Digital Private-Line" Test Set.

d. Troubleshooting

If the encoder-decoder performance is unsatisfactory, first thoroughly inspect the radio set and, particularly, the "DPL" encoder-decoder board. Check for visible defects in circuit boards, components and wiring. After any visible defects have been corrected, test the radio set and "DPL" board operation again. If performance is still unsatisfactory, use the following troubleshooting chart to help you isolate the defective circuit and component.

"DIGITAL PRIVATE-LINE" ENCODER-DECODER TROUBLESHOOTING CHART

Use this troubleshooting chart as a supplement to the maintenance information on the schematic diagram.

| SYMPTOM | PROBABLE CAUSE | CIRCUIT CHECKS |
|--|--|--|
| Transmitter has no power output. Transmit relay doesn't operate. | No A+ from PTT delay circuit. | 1. Check PTT switch circuit. 2. Check PTT delay circuit. |
| Transmitter causes squelch tails in "DPL"-equipped receivers. | Turn-off code not being sent, or is of insufficient duration or deviation. | 1. Check turn-off code deviation: should be ± 500 to ± 1000 Hz. Turn-off code should begin as soon as PTT button is released. Transmitter should remain keyed for 160 to 250 msec after PTT button is released. 2. Check PTT delay circuit. 3. Check U801-9: should be 0 V during delayed PTT. 4. Check Q821: must be off for proper low-pass filter operation during transmit. |
| Transmitter cannot unsquelch "DPL"-equipped receivers. | Insufficient transmitter "DPL" deviation. | Check "DPL" deviation: should be ± 500 to ± 1000 Hz. |
| | Incorrect or faulty "DPL" code. | 1. Check U801-15 through U801-23 for proper octal code. 2. Check U801-9: should be +6 V (high). |
| | Encoder filter is malfunctioning. | Check encoder filter (Q801-803 and Q821) for proper operation. |
| | 50 kHz oscillator is malfunctioning. | Check U801-4 for 50 kHz square wave. Rise time should be 750 nsec or less. |
| Receiver will not unsquelch in "DPL" operation. | Switch interface circuits are malfunctioning. | Check switch interface circuits (Q805 and Q806). Q806 emitter should be 12.8 V when U801-7 is high. |
| | U801 is not decoding properly. | 1. Check U801-7: should be 6 V when decoding a valid code. 2. Check U801-1: should be 0 V. 3. Check U801-12 with oscilloscope. You should see 6 V p-p pulses 1.84 msec apart. |

"DIGITAL PRIVATE-LINE" ENCODER-DECODER TROUBLESHOOTING CHART (Cont'd.)

| SYMPTOM | PROBABLE CAUSE | CIRCUIT CHECKS |
|-------------------------------------|---|---|
| | 50 kHz oscillator malfunctioning. | Check U801-4 for 50 kHz square wave. Rise time should be 750 nsec or less. |
| | U801 is not properly programmed. | Check U801-15 through U801-23 for proper octal code. |
| | U801 is in encode mode. | Check U801-9; should be low. |
| | Decoder filter and data conditioner malfunctioning. | Compare waveforms and voltages with those on the schematic diagram. |
| Excessive decoder falsing. | Decoder low-pass filter malfunctioning. | Check decoder filter response. At Q812 emitter the filter response should be -1 to -4 dB at 134 Hz and -12 to -15 dB at 250 Hz. Keep input signal below 400 mV p-p to keep CR803 and CR804 out of clip. |
| | Encoder-decoder U801 malfunctioning. | Check U801-7: should be low when no code is decoded. |
| | U803C in current source is on. | Check U803-9: should be 10.0 V when U801-7 is low. |
| Excessive blocking. | Decoder filter malfunctioning. | Check decoder filter response. See checks for excessive decoder falsing. |
| | Current source malfunctioning. | Check U803-9: should be 0.1 V when U801-7 is high. |
| Squelch open at all times in "DPL". | Switch interface circuit malfunctioning. | Check switch interface circuits (Q805 & Q806). |
| | U801 malfunctioning. | Check U801-7: should be 6 V except when valid code is decoded. |
| | Power supply voltage is not 6.2 V \pm .5 V. | Check voltage at U801-24. |
| | 50 kHz oscillator operating intermittently or at wrong frequency. | Check 50 kHz clock signal at U801-4: should be 50 kHz square wave. Rise time should be 750 nsec or less. |

5. MULTIPLE FREQUENCY MODIFICATION CONNECTIONS

The MULTIPLE FREQUENCY RADIOS JUMPER AND COMPONENT CONNECTIONS TABLE lists the standard and optional transmit (C) and receive (R) combinations. Radio sets ordered with non-standard combinations are modified as necessary at the factory. New system requirements for different transmit-receive combinations are easily handled by field modification.

The table lists the frequency combination in the first column. The other columns on the same line indicate which resistors are removed to disable unused oscillators. Jumper columns indicate diodes to be jumpered to ground (for single-frequency operation) or diodes to be jumpered together. Jumpered diodes provide a ground path for the unused oscillator's control leads to activate a desired oscillator. Refer to the transmitter and receiver circuit board detail for component locations.

6. FRONT PANEL AND KEY LOCK REMOVAL

The radio set is completely accessible for service without removing the front panel. Unusual circumstances, such as front panel damage, may necessitate front panel replacement.

To remove the front panel, the key lock must be dismantled, the escutcheon removed and the four front panel screws must be removed. The escutcheon may be glued to the front panel so use care during its removal to prevent buckling. A special tool, Motorola Part No. 66A84909B01, is required to free the lock barrel from the outside housing which in turn permits the locking bar to be removed. Refer to the heatsink and housing detail in the rear of this instruction manual before attempting to remove the lock barrel.

The lock barrel is removed as follows:

(1) Insert the key into the lock and turn the key horizontally to the unlocked position.

(2) Insert tool (No. 66A84909B01), with the beveled edge of the tool facing upward, into the small slot in the front end of the lock.

(3) Push the tool in until it stops and turn 180° clockwise.

(4) Pull the key, this removes the key and the barrel from the lock housing.

(5) If the lock has a metal locking bar, remove the locking bar spring. Plastic lock bars do not require springs.

(6) Remove the lock bar.

Re-assembling the front panel and key lock is accomplished by reversing the order of the steps.

| DESIRED FREQUENCY COMBINATION | 2-FREQ. CONTROL HEAD (NOTE 2) | 4-FREQ. CONTROL HEAD (NOTE 2) | TRANSMIT & RECEIVE OSCILLATORS ACTIVATED WHEN CONTROL HEAD FREQUENCY SWITCH IS IN THE POSITION INDICATED | | | |
|-------------------------------------|--|--|--|------------|------------|------------|
| | | | POSITION 1 | POSITION 2 | POSITION 3 | POSITION 4 |
| C1-R1 | X | | T1/R1 | T2/R2 | | |
| C1-R1 | | X | T1/R1 | T2/R2 | T3/R3 | T4/R4 |
| C1-R2 | X | | T1/R1 | T1/R2 | | |
| C1-R2 | | X | T1/R1 | T1/R2 | T1/R3 | T1/R4 |
| C1-R3 | | X | T1/R1 | T1/R2 | T1/R3 | T1/R4 |
| C1-R4 | | X | T1/R1 | T1/R2 | T1/R3 | T1/R4 |
| C2-R1 | X | | T1/R1 | T2/R1 | | |
| C2-R1 | | X | T1/R1 | T2/R1 | T3/R1 | T4/R1 |
| C2-R2 | X | | T1/R1 | T2/R2 | | |
| C2-R2 | | X | T1/R1 | T2/R2 | T3/R3 | T4/R4 |
| C2-R3 | | X | T1/R1 | T2/R2 | T2/R3 | T2/R4 |
| C2-R4 | | X | T1/R1 | T2/R2 | T2/R3 | T2/R4 |
| C3-R1 | | X | T1/R1 | T2/R1 | T3/R1 | T4/R1 |
| C3-R2 | | X | T1/R1 | T2/R2 | T3/R2 | T4/R2 |
| C3-R3 | | X | T1/R1 | T2/R2 | T3/R3 | T4/R4 |
| C3-R4 | | X | T1/R1 | T2/R2 | T3/R3 | T3/R4 |
| C4-R1 | | X | T1/R1 | T2/R1 | T3/R1 | T4/R1 |
| C4-R2 | | X | T1/R1 | T2/R2 | T3/R2 | T4/R2 |
| C4-R3 | | X | T1/R1 | T2/R2 | T3/R3 | T4/R3 |
| C4-R4 | | X | T1/R1 | T2/R2 | T3/R3 | T4/R4 |

NOTES:

1. INSTA
2. MODIF
BEING
3. TO MC
WIRES

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(2) Insert tool (No. 66A84909B01), with the beveled edge of the tool facing upward, into the small slot in the front end of the lock.

(3) Push the tool in until it stops and turn 180° clockwise.

(4) Pull the key, this removes the key and the barrel from the lock housing.

(5) If the lock has a metal locking bar, remove the locking bar spring. Plastic lock bars do not require springs.

(6) Remove the lock bar.

Re-assembling the front panel and key lock is accomplished by reversing the order of the steps.

MULTIPLE FREQUENCY RADIO SETS
JUMPER AND COMPONENT CONNECTIONS TABLE

| DESIRED FREQUENCY COMBINATION | 2-FREQ. CONTROL HEAD (NOTE 2) | 4-FREQ. CONTROL HEAD (NOTE 2) | NO MODIFICATION REQUIRED | TRANSMITTER OSCILLATOR MODIFICATIONS | | | | | | | | RECEIVER OSCILLATOR MODIFICATIONS | | | | | | | | TRANSMIT & RECEIVE OSCILLATORS ACTIVATED WHEN CONTROL HEAD FREQUENCY SWITCH IS IN THE POSITION INDICATED | | | |
|-------------------------------------|--|--|--------------------------------|--------------------------------------|------|------|---|-------|-------|-------|------|-----------------------------------|------|--------|---|-------|-------|------------|------------|--|------------|--|--|
| | | | | REMOVE THE INDICATED RESISTORS | | | JUMPER THE INDICATED DIODE ANODES TOGETHER | | | | | REMOVE THE INDICATED RESISTORS | | | JUMPER THE INDICATED DIODE ANODES TOGETHER | | | | | | | | |
| | | | | R466 | R473 | R480 | CR101 | CR461 | CR463 | CR465 | R432 | R435 | R438 | CR40 | CR430 | CR431 | CR432 | POSITION 1 | POSITION 2 | POSITION 3 | POSITION 4 | | |
| C1-R1 | X | | | | X | X | | | | | | X | X | | | | | T1/R1 | T2/R2 | | | | |
| C1-R1 | | X | X | | | | | | | | | X | X | | | | | T1/R1 | T2/R2 | T3/R3 | T4/R4 | | |
| C1-R2 | X | | | X | X | X | Note 1 | | | | | X | X | | | | | T1/R1 | T1/R2 | | | | |
| C1-R2 | | X | | X | X | X | Note 1 | | | | | | | | | | | T1/R1 | T1/R2 | T1/R3 | T1/R4 | | |
| C1-R3 | | X | | X | X | X | Note 1 | | | | | | | | | | | T1/R1 | T1/R2 | T1/R3 | T1/R4 | | |
| C1-R4 | | X | | X | X | X | Note 1 | | | | | | | | | | | T1/R1 | T1/R2 | T1/R3 | T1/R4 | | |
| C2-R1 | X | | | | X | X | | | | | X | X | X | Note 1 | | | | T1/R1 | T2/R1 | | | | |
| C2-R1 | | X | | | | | | | | | X | X | X | Note 1 | | | | T1/R1 | T2/R1 | T3/R1 | T4/R1 | | |
| C2-R2 | X | | | | X | X | | | | | | X | X | | | | | T1/R1 | T2/R2 | | | | |
| C2-R2 | | X | X | | | | | | | | | | | | | | | T1/R1 | T2/R2 | T3/R3 | T4/R4 | | |
| C2-R3 | | X | | | X | X | | ● | ● | ● | | | | | | | | T1/R1 | T2/R2 | T2/R3 | T2/R4 | | |
| C2-R4 | | X | | | X | X | | ● | ● | ● | | | | | | | | T1/R1 | T2/R2 | T2/R3 | T2/R4 | | |
| C3-R1 | | X | | | | | | | | | X | X | X | Note 1 | | | | T1/R1 | T2/R1 | T3/R1 | T4/R1 | | |
| C3-R2 | | X | | | | | | | | | | X | X | | ● | ● | ● | T1/R1 | T2/R2 | T3/R2 | T4/R2 | | |
| C3-R3 | | X | X | | | | | | | | | | | | | | | T1/R1 | T2/R2 | T3/R3 | T4/R4 | | |
| C3-R4 | | X | | | | X | | | | ● | ● | | | | | | | T1/R1 | T2/R2 | T3/R3 | T3/R4 | | |
| C4-R1 | | X | | | | | | | | | X | X | X | Note 1 | | | | T1/R1 | T2/R1 | T3/R1 | T4/R1 | | |
| C4-R2 | | X | | | | | | | | | | X | X | | ● | ● | ● | T1/R1 | T2/R2 | T3/R2 | T4/R2 | | |
| C4-R3 | | X | | | | | | | | | | | X | | | ● | ● | T1/R1 | T2/R2 | T3/R3 | T4/R3 | | |
| C4-R4 | | X | X | | | | | | | | | | | | | | | T1/R1 | T2/R2 | T3/R3 | T4/R4 | | |

- NOTES:
1. INSTALL A JUMPER FROM THE ANODES OF THE INDICATED DIODE TO GROUND.
 2. MODIFICATION REQUIRED DIFFER DEPENDING ON WHETHER A TWO-FREQUENCY OR FOUR-FREQUENCY CONTROL HEAD IS BEING USED.
 3. TO MODIFY A MULTI-FREQUENCY RADIO FOR C1-R1 OPERATION WITH A SINGLE FREQUENCY CONTROL HEAD, PLACE JUMPER WIRES FROM THE ANODES OF CR101 AND CR40 TO GROUND. PLACE THE CRYSTALS IN OSCILLATORS T1 AND R1.

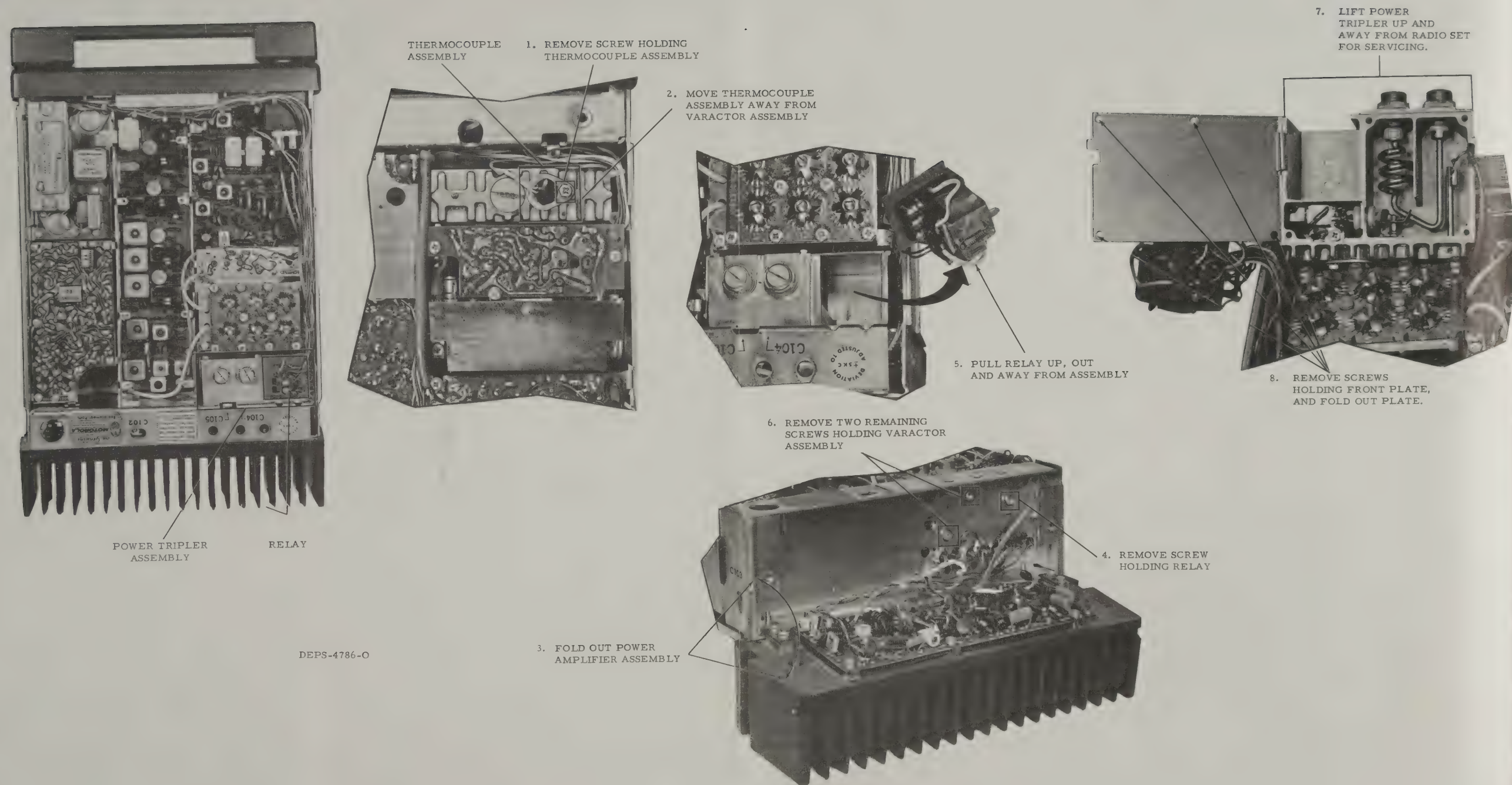
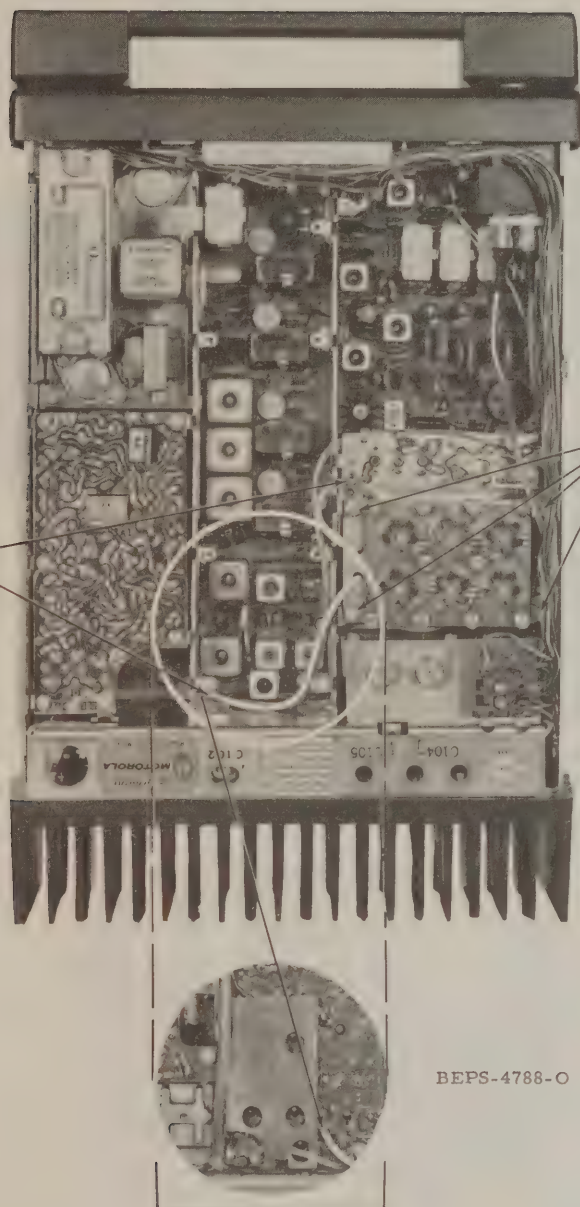


Figure 12.
Power Tripler Removal

1. UNSOLDER
RF DECK
LEADS.

2. REMOVE
SCREWS AND
LIFT RF DECK
OUT OF RADIO.



BEPS-4788-O

BOTTOM SIDE
OF
RADIO

Figure 13
RF Deck Removal

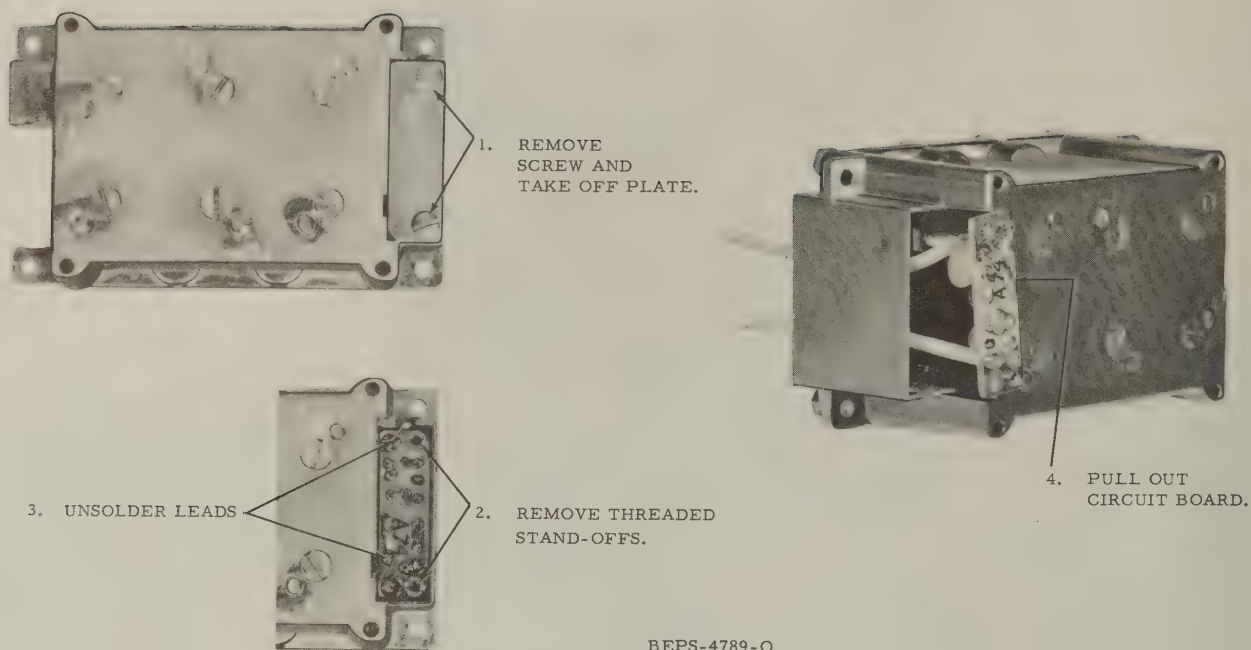


Figure 14.
RF Deck Disassembly

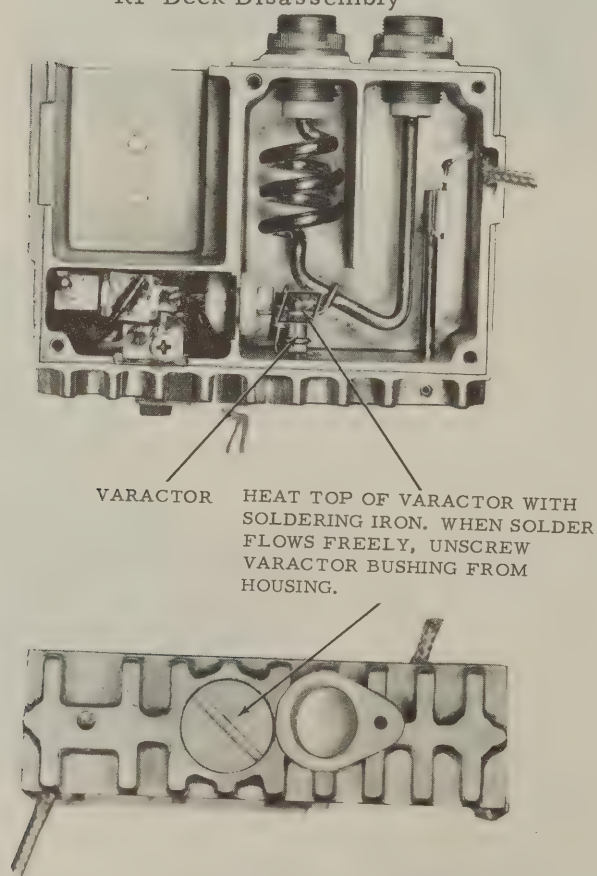


Figure 15.
Varactor Diode Removal

TABLE OF RECOMMENDED TEST EQUIPMENT

| TYPE OF EQUIPMENT OR TYPE OF MEASUREMENT | EQUIPMENT CHARACTERISTICS | RECOMMENDED TYPE |
|--|--|---|
| All | Select battery operated test equipment, where available, for versatility. Battery operated equipment permits testing in the vehicle or on the bench. | See your Motorola sales representative before ordering test equipment. He will analyze your requirements and help you select the latest available equipment to suit your individual needs. He can also advise you of new servicing equipment which becomes available after the printing of this manual. |
| Power supply for bench testing | Capability: 13.6 V @ 15 amp | Motorola Model S1346A Regulated Power Supply, or Motorola T1012A Power Supply with Motorola TEK-15A Ripple Filter. |
| Test harness for bench testing | Must simulate conditions of installation in vehicle including fusing, volume and squelch controls, frequency selection, speaker loading. | "Mocom - 70" cables, control head, microphone and speaker, or Motorola TEK-25 or TEK-29 Universal Control Panel with TEKA-48 Accessory Power & Control Cable. |
| Portable test set | No equivalent. Use only recommended type. | Motorola S1056B to S1059B Series Portable Test Set with Motorola Model SKN6012B Metering Cable |
| Transmitter frequency measurement | Frequency - 50-500 MHz Accuracy - $\pm 0.00005\%$ or better | Any of the following items of Motorola test equipment: Model S1343/1344 Series Digital Frequency/Deviation Meter Model S1315A Frequency Calibrator Model S1343 Series Digital Frequency/Period Counter |
| Transmitter deviation measurement | Peak reading type for voice or sinusoidal wave; scales for accurate reading of ± 5 kHz deviation (and ± 1 kHz deviation for "Private-Line" models). | Motorola Model S1059B Portable Test Set, or Motorola S1344 Series Digital Frequency/Deviation Meter |
| Transmitter power output measurement | 450-512 MHz; 50 ohms; at least 0-50 watt capability | Use any of the following: Model T1005A "Termaline" Wattmeter Model T1007A "Termaline" Wattmeter Model T1001A "ThruLine" Wattmeter with T1013A Load Resistor |
| RF signal generator for receiver testing | 450-512 MHz; FM; high stability - ($\pm 0.001\%$ or better); adjustable output 0 to 100 millivolts | Motorola S1341A or S1342A Series Solid-State FM Signal Generator |
| Audio voltage measurements | High impedance (10 megohm); dBm scale | Motorola Solid-State AC Voltmeter |
| Audio signal generator for audio circuit testing in receiver and transmitter | Variable amplitude 0 to 1 volt; 1000 Hz tone (300 to 3000 Hz preferred); sinusoidal wave. | Motorola Model S1067A Solid-State Audio Oscillator or Model TEK-1B Tone Oscillator |
| DC voltage measurements, resistance measurements, rf voltage measurements. | High impedance (11 megohm) dc multimeter. | Motorola Solid-State DC Multimeter with rf probe. |
| Waveform measurements | Oscilloscope; Audio circuit measurements | D61, D66 or D67 Telequipment Dual Trace Oscilloscope |
| "Private-Line" tone injection for PL decoder circuit measurements | "Private-Line" tone generator using "Vibrasender" resonant reed for frequency accuracy; or audio oscillator with frequency counter for accurate setting of oscillator. | Motorola Model SLN6221A "Private-Line" Tone Generator |

EPS-4791-G

G. TRANSMITTER ADJUSTMENT (CONT'D)

to all radios.

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power

| ADJUSTMENT | METER READING | PROCEDURE |
|------------------------------------|------------------|---|
| | | Key transmitter. |
| L102, L103 | PEAK | Tune the oscillator output coils L102 and L103, in that order, for a peak reading in position 3. For multi-frequency radios, make all tuning adjustments on the lowest transmitter frequency. |
| L104 | | Tune L104 for a PEAK indication on meter 5 if possible. If position 5 does not read, tune L104 for a minimum reading in meter position 3. |
| L105, L106 | PEAK | Tune the tripler output coils L105 & L106, in that order, for a peak reading in position 5. |
| C101 | PEAK | Tune the 1st amplifier output trimmer capacitor, C101, for a peak reading in position 5. |
| L102, L103, L104, L105, L106, C101 | PEAK | Repeat step 3. Tune L104 for a peak indication on position 5. Repeat steps 5 and 6. |
| R105 | | Set the power output control, R105 fully counter-clockwise for maximum power output. |

tain only to 450-470 MHz radios.

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2. Moto
3. Moto
4. Moto
5. Moto
6. Moto
7. Moto

| | | |
|--|------|---|
| C105, C104, C103, C102 | PEAK | Be sure R105 is set per step 8. Tune C105, C104, C103, and C102, in that order for max. power output. |
| C101 | PEAK | Tune 1st amplifier output trimmer, C101, for a peak reading in position 5. |
| C105, C104, C103, C102 | PEAK | Repeat step 9. |
| tain only to 470-512 MHz radios. | | |
| R105, C103, C105, C104, C102 | PEAK | Be sure R105 is set per step 8. Tune C103, C105, C104, C103 again, and C102, in that order, for max. power output. |
| <u>IMPORTANT</u> | | |
| Two peaks may be observed when tuning C104. Tune to the peak nearest maximum clockwise rotation (maximum capacitance). | | |
| C101 | PEAK | Tune 1st amplifier output trimmer, C101, for a peak reading in position 5. |
| R105, C103, C105, C104, C102 | PEAK | Tune C103, C105, C104, C103 again, and C102, in that order, for maximum power output. If two peaks are observed while tuning C104, tune to the peak nearest maximum clockwise rotation. |

tain to wide-spaced transmitters only (i.e., multi-frequency transmitters in excess of 1.0 M-Hz but not exceeding 5.5 MHz).

| | | |
|------|--|---|
| R105 | | Set the power output control R105 fully clockwise. |
| L102 | Equal readings on f_{high} & f_{low} | Alternately switch between the highest and lowest transmit frequencies and adjust L102 for equal readings on meter 3. |
| L105 | Equal readings on f_{high} & f_{low} | Alternately switch between the highest & lowest transmit frequencies and adjust L105 for equal readings on meter 5. |

Transmitter Alignment Procedure
Motorola No. PEPS-4873-E
8/20/75-PO

CONTINUED ON REVERSE SIDE

TRANSMITTER PRE-ALIGNMENT NOTES

A. EXCERPTS FROM FCC REGULATIONS

FCC Regulations state that:

- Radio transmitters may be tuned or adjusted only by persons holding a 1st or 2nd class commercial radiotelephone operator's license or by personnel working under their immediate supervision.
- The rf power output of a radio transmitter shall be no more than that required for satisfactory technical operation considering the area to be covered and the local conditions.
- Frequency and deviation of a transmitter must be checked before it is placed in service and re-checked once each year thereafter.

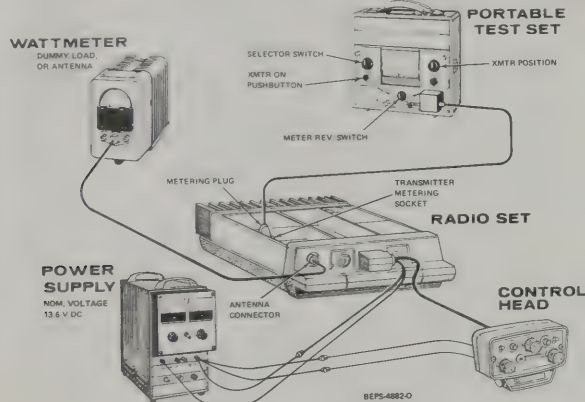
NOTE

Transmitters operating in the 450-470 MHz band are licensed to operate at or below a specified input power to the final amplifier. Use of this alignment procedure assures that this level will not be exceeded.

Transmitters operating in the 470-512 MHz band are licensed to operate at or below a specified effective radiated power (ERP). The ERP of a radio is dependent upon rf power output of the radio, antenna transmission line loss, antenna gain and antenna height. The rf power output for various ERP values of this radio are given in the ERP TABLE on the reverse side of this alignment procedure. Do not exceed the rf power output value specified.

B. TEST EQUIPMENT REQUIRED

- Motorola S1056B to S1059B Series Portable Test Set with a Motorola Model SKN6012B Metering Cable. A 0-50 microampere meter with 20,000 ohms equivalent series resistance may be used if a test set is not available. A modified Motorola S1327A or S1327B Monitor or equivalent must be used for "Digital Private-Line" deviation measurements.
- Motorola TLN4474A Alignment Tool Kit supplied with radio.
- Motorola Model T1005A "Termaline" Wattmeter or equivalent.
- Motorola Model S1346A DC Power Supply or equivalent.
- Motorola Model S1067A Audio Oscillator or equivalent.
- Motorola Model S1344 Series Digital Frequency Meter/Deviation Calibrator.
- Motorola Model S1053C Solid-State AC Voltmeter or equivalent.



Test Equipment Set-Up

C. HOW TO SET UP THE S1056A-9A PORTABLE TEST SET

- Set function selector switch to XMTR position.
- Place the oscillator and meter reversing switch in the OFF position.
- Connect the 20-pin meter cable plug to the test set; connect the other end of the cable to the transmitter metering socket. When the test set is not being used, disconnect the 20-pin metering cable to conserve internal battery life. The plug on the cable acts as an on-off switch completing the battery circuit.

D. HOW TO KEY THE TRANSMITTER

- Connect the rf wattmeter to the front panel antenna receptacle.
- Key the transmitter with XMTR-ON switch on the test set or with a microphone plugged into the test set or radio set control head.

CAUTION

Do not key the transmitter for more than a few seconds at a time until it is properly tuned. Turn on the transmitter for brief periods while reading the meter and making the adjustments.

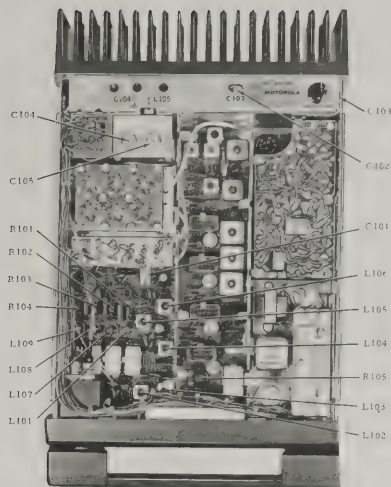
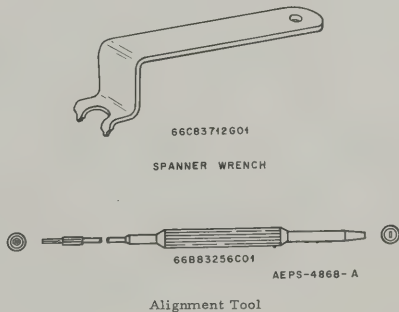
E. FREQUENCY CALCULATIONS

| FREQUENCY (MHz) | CALCULATION |
|-----------------|------------------------|
| 450-512 | $f_o - \frac{f_c}{27}$ |

Where f_o = crystal frequency, f_c = carrier frequency

F. TEST SET SELECTOR SWITCH POSITIONS

| S1056A-9A SERIES TEST SET | 3 | 5 | 7 |
|---------------------------|--------------------------|-------------------------|-------------------------|
| CIRCUIT METERED | Base of Buffer Amplifier | Output of 1st Amplifier | Final Amplifier Current |



AEPS-4871-O

Transmitter Adjustment Locations

G. TRANSMITTER ADJUSTMENT

| Steps 1 thru 8 apply to all radios. | | | | |
|-------------------------------------|--------------------------|--|---------------|--|
| STEP | TEST SET SWITCH POSITION | ADJUSTMENT | METER READING | PROCEDURE |
| 1 | | L101, L107, L108, L109, L102, L103, L104, L105, L106, C101, C102, C103, C104, C105, R105 | | This step is required only if the controls have been drastically misaligned, or if the transmitter frequency is being changed. If necessary, pre-position transmitter coil slugs L101, L107, L108, L109, L102, L104 and L105 to top of coil forms (i.e., the end of form farthest from circuit board). Pre-position coil slugs L103 10-1/2 turns from top of coil form and L106 15-turns from top of coil form. Set 1st amplifier trimmer capacitor (C101) 1/2-turn from fully clockwise position. Set power amplifier interstage capacitor (C102) fully clockwise. Set power amplifier output capacitor (C103) 1-turn from the fully clockwise position. Turn power tripler tuning screws (C104, C105) clockwise until they "bottom out". DO NOT FORCE. For 450-470 MHz radios only, turn C104 and C105 two complete turns counterclockwise from the full clockwise position. For all radios, turn power control (R105) fully clockwise (minimum power output position). |

G. TRANSMITTER ADJUSTMENT (CONT'D)

| Steps 1 thru 8 apply to all radios. | | | | |
|--|--------------------------|------------------------------------|--|--|
| STEP | TEST SET SWITCH POSITION | ADJUSTMENT | METER READING | PROCEDURE |
| 2 | | | | Key transmitter. |
| 3 | 3 | L102, L103 | PEAK | Tune the oscillator output coils L102 and L103, in that order, for a peak reading in position 3. For multi-frequency radios, make all tuning adjustments on the lowest transmitter frequency. |
| 4 | 3 or 5 | L104 | | Tune L104 for a PEAK indication on meter 5 if possible. If position 5 does not read, tune L104 for a minimum reading in meter position 3. |
| 5 | 5 | L105, L106 | PEAK | Tune the tripler output coils L105 & L106, in that order, for a peak reading in position 5. |
| 6 | 5 | C101 | PEAK | Tune the 1st amplifier output trimmer capacitor, C101, for a peak reading in position 5. |
| 7 | 5 | L102, L103, L104, L105, L106, C101 | PEAK | Repeat step 3. Tune L104 for a peak indication on position 5. Repeat steps 5 and 6. |
| 8 | Wattmeter | R105 | | Set the power output control, R105 fully counterclockwise for maximum power output. |
| Steps 9 thru 11 pertain only to 450-470 MHz radios. | | | | |
| 9 | Wattmeter | C105, C104, C103, C102 | PEAK | Be sure R105 is set per step 8. Tune C105, C104, C103, and C102, in that order for max. power output. |
| 10 | 5 | C101 | PEAK | Tune 1st amplifier output trimmer, C101, for a peak reading in position 5. |
| 11 | Wattmeter | C105, C104, C103, C102 | PEAK | Repeat step 9. |
| Steps 12 thru 14 pertain only to 470-512 MHz radios. | | | | |
| 12 | Wattmeter | R105, C103, C105, C104, C102 | PEAK | Be sure R105 is set per step 8. Tune C103, C105, C104, C103 again, and C102, in that order, for max. power output. IMPEDANCE Two peaks may be observed when tuning C104. Tune to the peak nearest maximum clockwise rotation (maximum capacitance). |
| 13 | 5 | C101 | PEAK | Tune 1st amplifier output trimmer, C101, for a peak reading in position 5. |
| 14 | Wattmeter | R105, C103, C105, C104, C102 | PEAK | Tune C103, C105, C104, C103 again, and C102, in that order, for maximum power output. If two peaks are observed while tuning C104, tune to the peak nearest maximum clockwise rotation. |
| Steps 15 thru 20 pertain to wide-spaced transmitters only (i.e., multi-frequency transmitters with channel separation in excess of 1.0 MHz but not exceeding 5.5 MHz). | | | | |
| 15 | | R105 | | Set the power output control R105 fully clockwise. |
| 16 | 3 | L102 | Equal readings on f_{high} & f_{low} | Alternately switch between the highest and lowest transmit frequencies and adjust L102 for equal readings on meter 3. |
| 17 | 5 | L105 | Equal readings on f_{high} & f_{low} | Alternately switch between the highest & lowest transmit frequencies and adjust L105 for equal readings on meter 5. |

ALIGNMENT CONTINUED ON REVERSE SIDE

| G. TRANSMITTER ADJUSTMENT (CONT'D) | | | | |
|---|--------------------------|------------|--|---|
| STEP | TEST SET SWITCH POSITION | ADJUSTMENT | METER READING | PROCEDURE |
| 18 | 3, 5 | L102, L105 | Equal readings on f _{high} & f _{low} | Repeat steps 16 and 17 until meter 3 and meter 5 readings deviate less than 2 uA when transmitter is switched from highest to lowest frequency. |
| 19 | Wattmeter | R105 | | Set power output control R105 fully counterclockwise for maximum power output. |
| 20 | Wattmeter | C105 | Equal readings on f _{high} & f _{low} | If power output is not within 2 watts on highest and lowest frequencies, tune output screw of power tripler, C105, for nearly equal power levels. |
| Steps 21 and 22 apply to all radios. | | | | |
| 21 | Wattmeter | C104, C105 | Equal readings on f _{high} & f _{low} | Use Spanner Wrench provided in tuning tool kit to tighten locknuts on tuning screws C104 and C105. Use caution to avoid detuning these capacitors. Check power output on all frequencies. |
| 22 | 7 | C103 | Not more than 40 uA | Meter position 7 should read less than 40 uA. If necessary, turn C103 counterclockwise until meter 7 reads 40 uA. |
| Steps 23 and 24 pertain only to 450-470 MHz radios. | | | | |
| 23 | Wattmeter | R105 | 30 Watts | Set the power output control, R105, in the following manner. On multi-frequency radios use the transmit channel with the lowest power output. If the rf power output exceeds 30 watts, adjust R105 until power output is reduced to 30 watts. If power output is between 25 watts and 30 watts, increase the dc supply voltage until power output is equal to 31 watts and adjust R105 for 30 watts out. |
| 24 | | | 25 Watts minimum | On multi-frequency transmitters, check power output on all channels. If power on any channel is less than 25 watts, use that channel and readjust R105 as per step 23. |
| Steps 25 and 26 pertain only to 470-512 MHz radios. | | | | |
| 25 | Wattmeter | R105 | | Refer to the model number of the radio and find its listing in the ERP TABLE. Set the power output control R105 for the power output specified in the ERP TABLE. |
| 26 | Wattmeter | R105 | | On multi-frequency models check the power output on all channels. If the power output exceeds that specified in the table, readjust R105 for the specified value. |

| RADIO MODEL | *ERP | RF POWER OUTPUT | ANTENNA | |
|---|----------|-----------------|-------------|-------------|
| | | | 470-494 MHz | 494-512 MHz |
| U24BCA Series T24BCA Series D24BCA Series | 10 watts | 16 watts | TAE6054A | TAE6055A |
| U24BCA Series T24BCA Series D24BCA Series | 25 watts | 16 watts | TAE6074A | TAE6075A |
| U34BCA Series T34BCA Series D34BCA Series | 50 watts | 22 watts | TAE6064A | TAE6065A |

*ERP = Effective Radiated Power

NOTE
The FCC restricts transmitters in the 470-512 MHz range to operate at or below a specified ERP. Therefore, the rf power output of the radio should not exceed the values specified in the table.

H. FINAL METER READINGS

- Each time a transmitter is aligned or tested, final meter readings should be made and entered in a logbook.
- All readings given in the following table are minimum (based on a nominal dc supply voltage of 13.6 volts) except M7 (final amplifier current) which is a maximum reading.
- The readings at positions 3 and 5 are purely relative and do not give actual current or voltage measurements.
- Multiply the microampere scale reading obtained in position 7 by 0.2 to determine the actual final amplifier current in amperes.

EXAMPLE: Meter Reading = 40 uA
Multiplying Factor = 0.2
Actual Current = 40 x 0.2 = 8 amperes

| TRANSMITTER METERING TABLE | | | |
|----------------------------------|--|---|-------------------------|
| S1056A-9A SERIES SWITCH POSITION | 3 | 5 | 7 |
| METER READING | 5 uA min (normal tuning) 3 uA min (wide space tuning) | 15 uA min (normal tuning) 8 uA min (wide space tuning) | 40 uA (max) |
| CIRCUIT METERED | Oscillator Output | Exciter Output | Final Amplifier Current |

I. OSCILLATOR FREQUENCY ADJUSTMENT

Setting the oscillator "on frequency" should be done after the transmitter has been aligned, but before transmitter deviation is checked and set. To set the oscillator on frequency, perform the following steps:

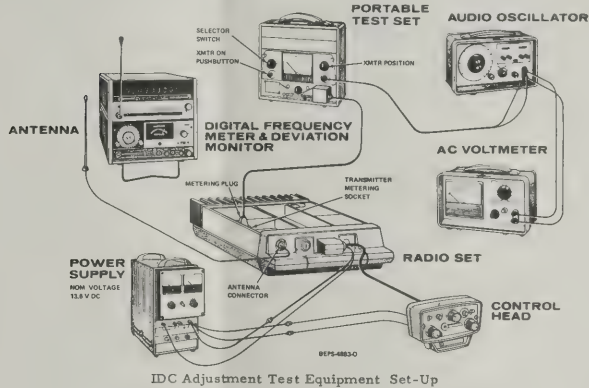
- Set up the frequency meter as described in the frequency meter instruction manual.
- Set the frequency selector switch on the control head to the F1 position (multi-freq. units only).
- Key the transmitter with no modulation using the portable test set. On "Private-Line" tone-coded squelch models, disable the "Private-Line" tone generator by removing the "Vibrasender" resonant reed. On "Digital Private-Line" binary-coded squelch models disable the encoder output by shorting the code disable points located between +6.2 V and the junction of R807 and R808.

- Adjust L101 for proper readings on the frequency meter. If the frequency as indicated on the frequency meter is too low, turn slug of L101 counterclockwise; if too high, turn clockwise.
- Set the frequency selector switch to the F2 position and repeat step 4 using L107.
- Repeat step 5 for F3 and F4 using L108 and L109 respectively.
- On "Private-Line" models, reinsert the "Vibrasender" resonant reed into the tone generator board or disconnect code disabling jumper.

NOTE
Omit steps 5 and 6 for single-frequency units.

J. "IDC" ADJUSTMENT PROCEDURE

NOTE
The IDC Adjustment must be made after the oscillator frequency adjustment has been made.

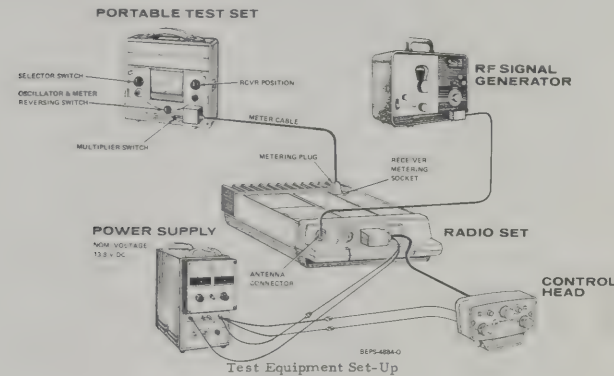


- Insert the "Vibrasender" resonant reed or code plug in "Private-Line" squelch models.
- Connect the output leads of the tone oscillator through a 0.33 uF capacitor to the transmitter audio input (microphone receptacle).
- Connect the ac voltmeter across the same terminals and adjust the tone generator output to 1 volt at 1000 Hz.
- Place the control head frequency selector switch in the F1 position (in multiple-frequency models) and key the transmitter using the portable test set. Adjust the F1 IDC control, R101, for 5 kHz deviation as read on the deviation measuring instrument used. For multiple frequency models adjust the F2, F3 and F4 IDC controls (R102, R103, and R104 respectively) with the frequency selector switch in the corresponding position.
- Reduce the tone oscillator output to 200 millivolts. Essentially full deviation should still be indicated. Less than full deviation may indicate a weak audio stage or other lack of audio gain.
- Remove the 1000 Hz modulation. "Private-Line" tone deviation should be between 0.5 to 1 kHz. "Digital Private-Line" deviation should be between 0.5 and 1 kHz; see B1 above.

RECEIVER ALIGNMENT PROCEDURE

A. TEST EQUIPMENT REQUIRED

- Motorola S1056B to S1059B Series Portable Test Set with Motorola Model SKN6012B Metering Cable.
- Motorola Model S1346A Regulated Power Supply (or equivalent).
- Motorola S1341A or S1342A Series Solid-State FM Signal Generator or equivalent.
- Motorola TLN4474A Alignment Tool Kit (supplied with radio). A small screwdriver may be used for some of the adjustments.



B. HOW TO SET UP THE S1056A-9A PORTABLE TEST SET

- Set function selector switch to RCVR position.
- Switch on 455 kHz crystal oscillator.
- Connect the 20-pin meter cable plug to the test set; connect the adapter cable to the cable coming from the test set; connect the other end of the adapter cable to the receiver metering socket. When the test set is not in use; disconnect the 20-pin metering cable to conserve internal battery life. The plug on the cable acts as an on-off switch completing the battery circuit.
- Connect the rf extension cable to the test set; connect the rf probe cable to the rf extension cable.

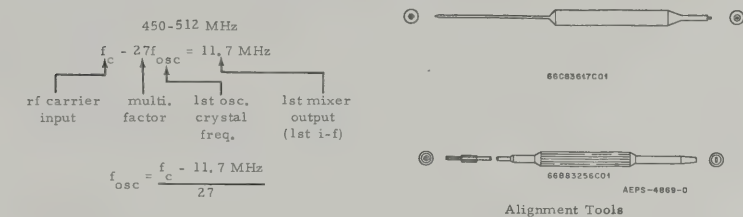
C. HOW TO SET UP THE SIGNAL GENERATOR FOR RF ALIGNMENT

- Set up the signal generator according to the instructions supplied with the unit.
- Connect the signal generator cable to the antenna input.
- Turn the generator output up to maximum.
- Keep the test set in position 4.
- Rotate the signal generator dial back and forth near the assigned rf carrier frequency. Watch the test set meter. The pointer should swing above and below the zero reading as the dial is rotated if the discriminator has been properly aligned. Set the dial for exact zero meter reading. Be sure the generator frequency is kept at zero meter reading.

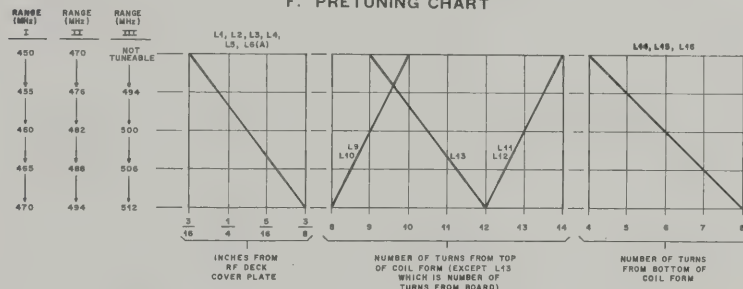
D. TEST SET SELECTOR SWITCH POSITIONS

| S1056A-9A TEST SET POSITION | 1 | 3 | 4 | 5 | 6 | 11 |
|-----------------------------|----------------------------------|--------------------------------|--------------------|----------------------------|-------------------------|--------------|
| TYPICAL NO SIGNAL READING | 0 uA | 16 uA | 0 uA | 25 uA | 18 uA | |
| CIRCUIT METERED | Base of 3rd 455 kHz IF Amplifier | Base of the Multiplier Tripler | Discriminator Zero | 3rd 455 kHz Limiter Output | 1st Oscillator Activity | Audio Output |

E. FREQUENCY CALCULATIONS



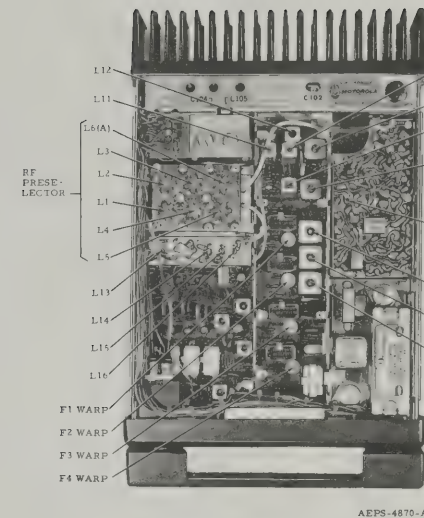
F. PRETUNING CHART



G. RECEIVER ALIGNMENT

455 kHz DISCRIMINATOR ALIGNMENT

| STEP | TEST SET SWITCH POSITION | ADJUSTMENT | METER READING | PROCEDURE |
|------|--------------------------|---|---------------|---|
| 1 | | L312 Disc. Primary | | Position slug flush with top of coil form. |
| 2 | | L313 Disc. Secondary | | Position slug to bottom of form (next to circuit board). |
| 3 | 5 | Discriminator Primary (Top Slug) L312 | PEAK | Inject a strong 455 kHz crystal-controlled signal from portable test set (25 uA minimum in position 1) to the input of the 455 kHz filter (collector of 2nd mixer - Q6). Tune L312 for a peak indication on meter position 5. |
| 4 | 4 | Disc. Secondary (Bottom Slug - nearest to circuit board) L313 | ZERO | Tune exactly to zero. DO NOT readjust primary. |



Receiver Adjustment Locations

G. RECEIVER ALIGNMENT (CONT'D)

455 kHz DISCRIMINATOR ALIGNMENT

| STEP | TEST SET SWITCH POSITION | ADJUSTMENT | METER READING | PROCEDURE |
|------|--------------------------|---------------------------------------|---------------|---|
| 5 | | L9, L10, L11, L12, L13, L14, L15, L16 | | This step is required only if these coils have been drastically misaligned, or if the receiver frequency is being changed. If necessary, preposition the oscillator multiplier coil slugs according to the pretuning chart. |

FIRST OSCILLATOR MULTIPLIER ALIGNMENT

| | | | | |
|---|------|----------------------------|-------|--|
| 6 | 6 | L9, L10 | PEAK | Tune L9 and L10 for a peak indication on position 6. |
| 7 | 3 | L11, L12, L13 | PEAK | Tune L11, L12 and L13 for a peak indication on position 3. |
| 8 | 6, 3 | L9, L10, L11, L12, L13 | PEAKS | Repeat steps 6 and 7. |
| 9 | | L1, L2, L3, L4, L5, L6 (A) | | This step is required only if these coils have been drastically misaligned or if the receiver frequency is being changed. RF DECK - use a screwdriver to preset the rf deck tuning screws L1 thru L6 (A) by turning the tuning screws counterclockwise (away from the top plate) until screws protrude according to the pretuning chart. |

G. RECEIVER ALIGNMENT (CONT'D)

FIRST OSCILLATOR MULTIPLIER ALIGNMENT

| STEP | TEST SET SWITCH POSITION | ADJUSTMENT | METER READING | PROCEDURE |
|------|--------------------------|---------------|---------------|---|
| 10 | 1 | L14, L15, L16 | PEAK | Set signal generator "on frequency" and tune L14, L15, and L16 for peak indication in position 1. Reduce signal generator level as necessary to maintain a meter 1 reading of below 30 uA. Repeat the procedures, carefully tuning all coils to a precise peak. |

1ST IF AND RF DECK ALIGNMENT

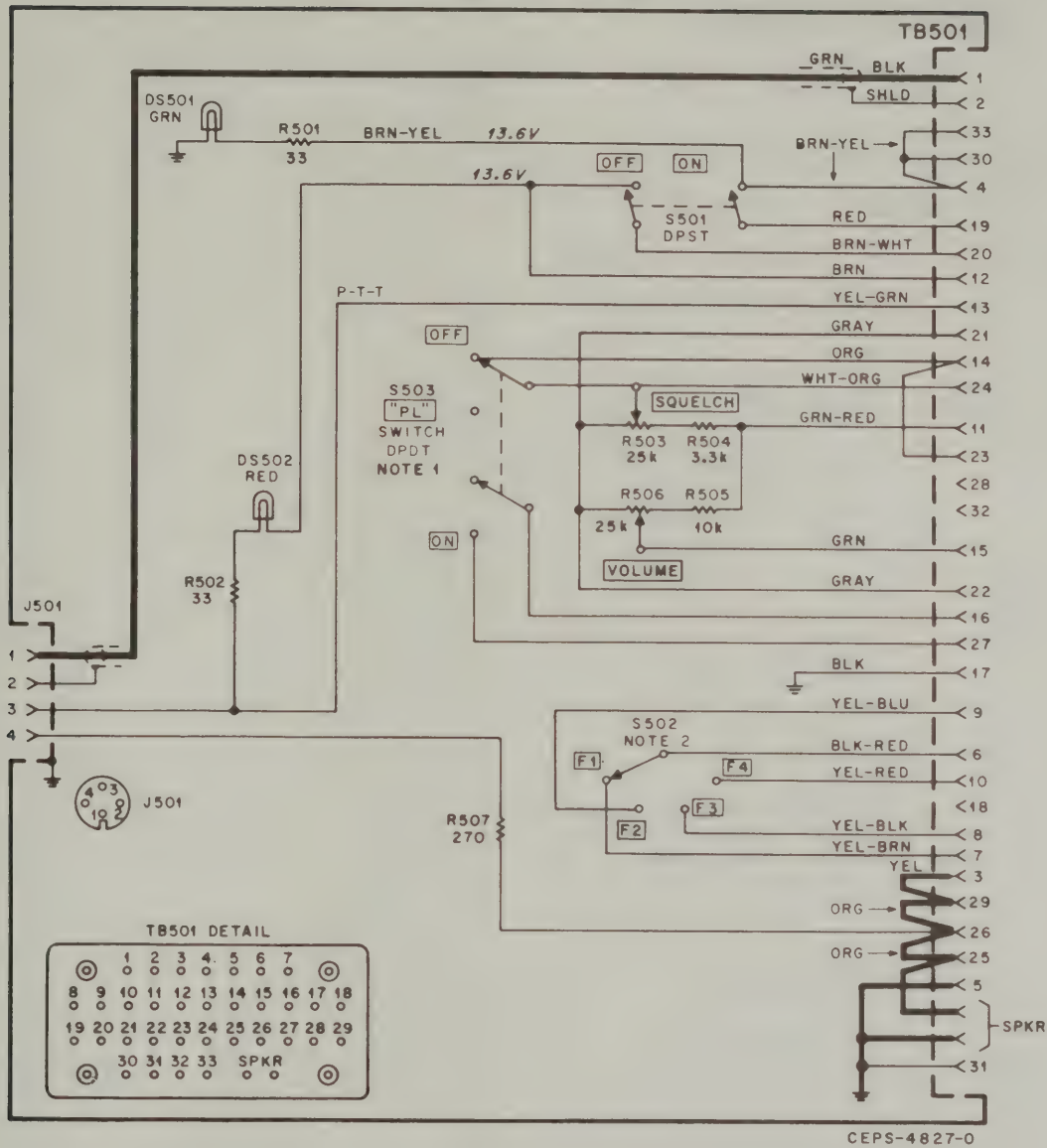
| | | | | |
|-----|-----------------------|---|---------------|--|
| 11 | 1 | L1, L2, L3, L4, L5, L6 (A) | PEAK | RF DECK - If the radio is equipped with the optional preamplifier, disconnect and bypass the preamplifier. Tune L1 through L6 (A) in that order for a maximum indication on meter position 1. Reduce generator output level as required to keep meter 1 reading below 30 uA. |
| 12 | 1 | L6 (B), T1, T2, L7, L8 | PEAK | 11.7 MHz IF - with rf generator on carrier frequency, tune coils L6 (B), T1, T2, L7 and L8 for a peak indication on meter position 1. Reduce rf generator output as required to maintain meter 1 reading below 30 uA. (Coils should tune with slugs positioned approximately 4-1/2 turns from top of form. Pre-position slugs to facilitate tuning if high i-f has been drastically misaligned.) |
| 13 | 1 | L14, L15, L16, L1, L2, L3, L4, L5, L6 (A) | PEAK | Repeat steps 10 and 11. |
| 14 | 11 or Audio Voltmeter | L15, L16, L5, L6 (A) | Best Quieting | Reduce the rf generator input to the 20 dB quieting level. Retune L15 and L16 on the injection tripler and L5 and L6 (A) on the rf deck for best quieting. |
| 15* | 1 | C1, C2 | PEAK | RF PREAMPLIFIER - If the radio is equipped with an optional preamplifier, reconnect the preamplifier. Tune C1 and C2 for a peak indication on position 1. Reduce generator output level to keep meter 1 reading below 30 uA. |
| 16* | 11 or Audio Voltmeter | C1, C2, L1, L2 | Best Quieting | Reduce the signal generator output to the 20 dB quieting level and repeat C1 and C2 on the preamplifier and L1 and L2 on the rf deck for best quieting sensitivity. |

*Skip this step unless the radio set is equipped with an optional RF Preamplifier.

RECEIVER FREQUENCY ADJUSTMENT

| | | | | |
|----|---|--|------|--|
| 17 | 4 | C1 (Freq. #1), C2 (Freq. #2), C3 (Freq. #3), C4 (Freq. #4) | 0 uA | With a carrier of known frequency on the air, set the corresponding oscillator warp capacitor to obtain a 0 uA reading in meter position 4. If the radio's receiver and transmitter are on the same frequency and if the transmitter is warped "on frequency", then the receiver may be netted to the transmitter by using the built-in netting function. Remove one end of the wire netting jumper, located near L105 in the exciter, from its pin and connect it to the pin located near CR180 in the exciter IDC circuit. This activates the low level exciter stages, which quiets the receiver. Set the corresponding receiver oscillator warp capacitor to obtain a 0 uA reading in meter position 4. |
|----|---|--|------|--|

TRUNK-MOUNT CONTROL HEAD



NOTES:

1. S503 AND ASSOCIATED WIRING USED IN "PRIVATE-LINE" MODELS ONLY.
2. S502 AND ASSOCIATED WIRING USED IN MULTIPLE FREQUENCY MODELS ONLY.

EPS-4864-O

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

Control Head Used in 1- &
4-Frequency Radio Sets
Schematic Diagram
Motorola No. 63P81011E42-A
8/20/75-PO

| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|---------------------|----------------------|-------------|
|---------------------|----------------------|-------------|

PARTS LIST

CONTROL HEADS

TRUNK-MOUNT
1-FREQ. & 4-FREQ.

TCN6026AE (Carrier Squelch, 1-Freq.)
TCN6026AG ("Private-Line" Tone-Coded Squelch, 1-Freq.)
TCN6026AJ (Carrier Squelch, 4-Freq.)
TCN6026AK ("Private-Line" Tone-Coded Squelch, 4-Freq.)

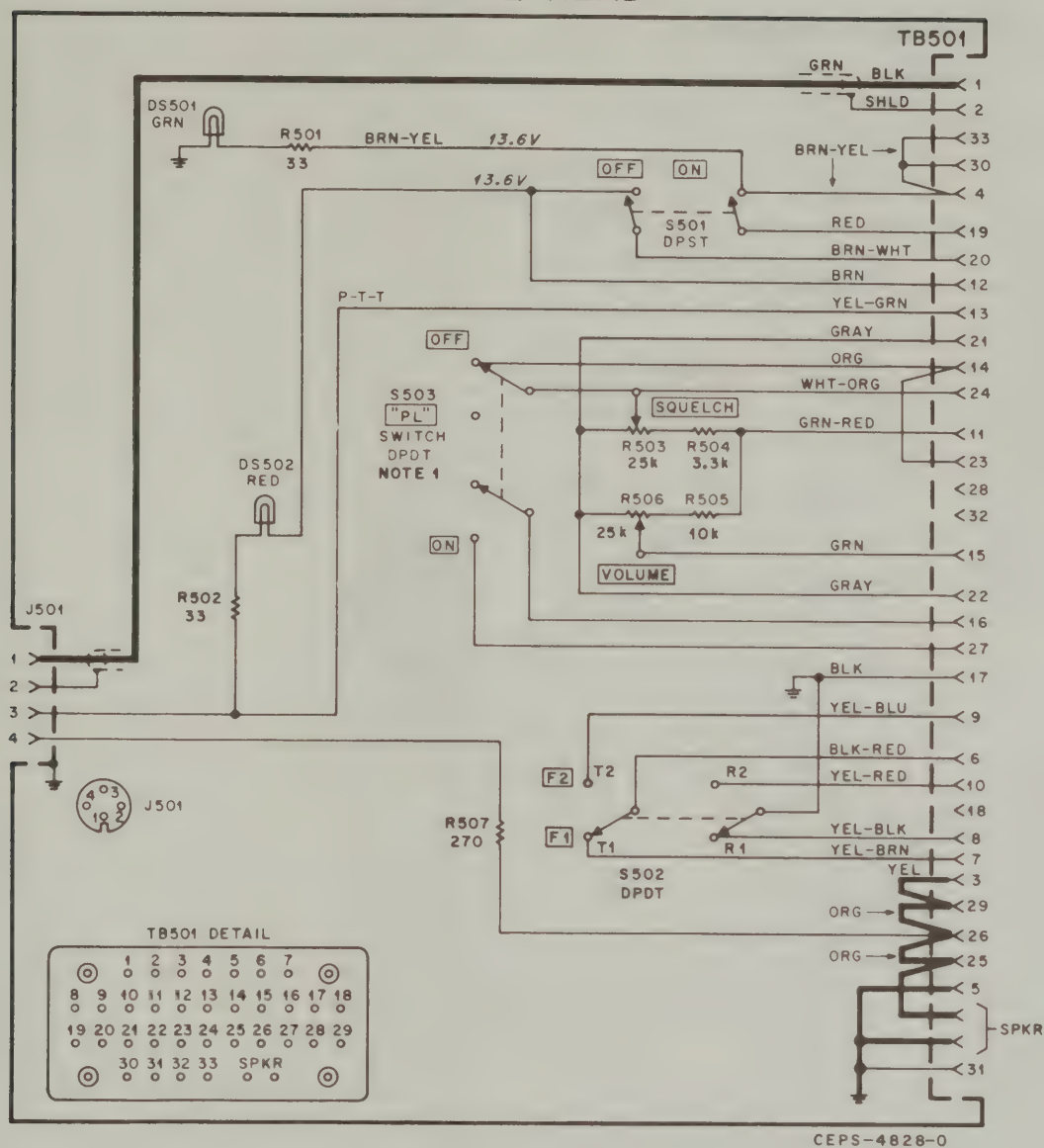
PL-772-C

| | | |
|-------------|--------------|---|
| DS501, 502 | 65K4151 | <u>LAMP, incandescent:</u> min. bay.; 6-8 V; 0.2 A; type No. 51 |
| J501 | 9K830418 | <u>CONNECTOR, receptacle:</u> female; 4-contact; does not include: 4S7699 LOCKWASHER; 13/16" internal; 2A482070 NUT, machine: ring type (knurled) |
| R501, 502 | 17C82350A04 | <u>RESISTOR, fixed: ±10%; 1/2 W:</u> unl stated |
| R503 | 18K857840 | 33 ±10%; 2 W |
| R504 | 6S5581 | variable: 25K ±30%; 0.33 W |
| R505 | 6S6320 | 3.3K |
| R506 | 18K868896 | 10K |
| | | variable: 25K ±30%; 0.33 W; |
| | or 18C857698 | includes switch S501 (TCN6026AE, AJ) |
| R507 | 6S6336 | variable: 25K ±30%; 0.33 W (TCN6026AG, AK) |
| S501 | or 40K80247 | 270; 1 W |
| S502 | 40C83624D01 | <u>SWITCH:</u> dpst; p/o R506 (TCN6026AE, AJ) |
| S503 | 40A80246 | toggle: dpst (TCN6026AG, AK) |
| TB501 | 31C83826D02 | rotary: 1-pole; 4-position; |
| XDS501, 502 | 9B863168 | non-shorting toggle: dpdt |
| | | <u>TERMINAL BOARD:</u> 35 female contacts |
| | | <u>LAMPHOLDER:</u> miniature bayonet type |

NON-REFERENCED ITEMS

| | |
|-------------|--|
| 61B83678D01 | LENS, indicator light: RED |
| 61B83678D02 | LENS, indicator light: GRN |
| 3A82670A01 | SCREW, machine: special type; 2 req'd (control head mounting) |
| 36K858652 | KNOB, control: 2 req'd (VOL & SQ.) |
| 36B82869D01 | KNOB, control: (freq. selector) |
| 26B83806D01 | SHIELD, light: (for light- dependent resistor located on "dimmer" board) |
| 3A82227A02 | SCREW, machine: special type: 4 req'd |
| 15C82401D01 | COVER, housing: (back) |
| 1V868494 | HOUSING, control head |
| 13D857971 | ESCUTCHEON (TCN6026AE) |
| 13D857975 | ESCUTCHEON (TCN6026AG) |
| 13D82286C23 | ESCUTCHEON (TCN6026AJ) |
| 13D82286C22 | ESCUTCHEON (TCN6026AK) |
| 7B82400D01 | BRACKET, control head mounting |
| 3S7302 | SCREW, machine: 10-32 x 3/8" plain hex head; 2 req'd (for mounting control head on bracket) |
| 3S7544 | SCREW, tapping: No. 8 x 1/2" plain hex head; 3 req'd. (for mounting bracket) |

TRUNK-MOUNT CONTROL HEAD



NOTES:

1. S503 AND ASSOCIATED WIRING USED IN "PRIVATE-LINE" MODELS ONLY.

EPS-4832-O

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

Control Head Used in 2-Frequency
Radio Sets Schematic Diagram
Motorola No. 63P81011E43-A
8/20/75-PO

| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|---------------------|----------------------|-------------|
|---------------------|----------------------|-------------|

PARTS LIST

CONTROL HEADS

TRUNK-MOUNT, 2-FREQUENCY

TCN6026AF (Carrier Squelch)

TCN6026AH ("Private-Line" Tone-Coded Squelch)

PL-775-D

| | | |
|----------------------|--|---|
| DS501, 502 | 65K4151 | <u>LAMP, incandescent:</u> min. bay.; 6-8 V; 0.2 A; type No. 51 |
| J501 | 9K830418 | <u>CONNECTOR, receptacle:</u> female; 4-contact; does not include: 4S7699 LOCKWASHER; 13/16" internal; 2A482070 NUT, machine: ring type (knurled) |
| R501, 502 | 17C82350A04 | <u>RESISTOR, fixed: ±10%; 1/2 W:</u> unl stated 33 ±10%; 2 W |
| R503 | 18K857840 | variable: 25K ±30%; 0.33 W |
| R504 | 6S5581 | 3.3K |
| R505 | 6S6320 | 10K |
| R506 | 18K868896 | variable: 25K ±30%; 0.33 W; includes switch S501 (TCN6026AH) |
| | or 18C857698 | variable: 25K ±30%; 0.33 W (TCN6026AF) |
| R507 | 6S6336 | 270; 1 W |
| S501 | | <u>SWITCH:</u> dpst; p/o R506 (TCN6026AH) |
| S502, 503 | or 40K80247 40A80246 | toggle: dpst (TCN6026AF) toggle: dpdt |
| TB501 | 31C83826D02 | <u>TERMINAL BOARD:</u> 35 female contacts |
| XDS501, 502 | 9B863168 | <u>LAMPHOLDER:</u> miniature bayonet type |
| NON-REFERENCED ITEMS | | |
| | 61B83678D01 61B83678D02 3A82670A01 | LENS, indicator light: RED LENS, indicator light: GRN SCREW, machine: special type; 2 req'd (control head mounting) |
| | 36K858652 | KNOB, control: 2 req'd (VOL & SQ.) |
| | 3A82227A02 | SCREW, machine: special type; 4 req'd. |
| | 15C82401D01 | COVER, housing: (back) |
| | 1V868494 | HOUSING, control head |
| | 13K857972 | ESCUTCHEON (TCN6026AF) |
| | 13K857976 | ESCUTCHEON (TCN6026AH) |
| | 7B82400D01 | BRACKET, control head mounting |
| | 3S7302 | SCREW, machine: 10-32 x 3/8" plain hex head; 2 req'd (for mounting control head on bracket) |
| | 3S7544 | SCREW, tapping: No. 8 x 1/2" plain hex head; 3 req'd (for mounting bracket) |

TB501

GRN BLK < 1
 -- SMLD < 2

BRN-YEL 13.6V
 13.6V

CR503

OFF ON
 S504 DPST

BRN-YEL
 RED
 BRN-WHT
 BRN
 YEL-GRN
 GRAY
 ORG
 WHT-ORG
 GRN-RED

P-T-T
 OFF
 S503
 "PL" o
 SWITCH DPDT NOTE 1
 ON

DS502 RED
 K
 R542 50

SQUELCH
 R503 25k R504 3.3k
 R506 25k R505 10k
 VOLUME

GRN
 GRAY
 BLK
 YEL-BLU
 BLK-RED
 YEL-RED
 YEL-BLK
 YEL-BRN
 YEL
 ORG
 ORG

F2 T2 R2
 F1 T1 R1
 S502 DPDT

R507 270

SPKR
 31

7 18
 8 29
 9

45

| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|---------------------|----------------------|-------------|
|---------------------|----------------------|-------------|

PARTS LIST

CONTROL HEADS

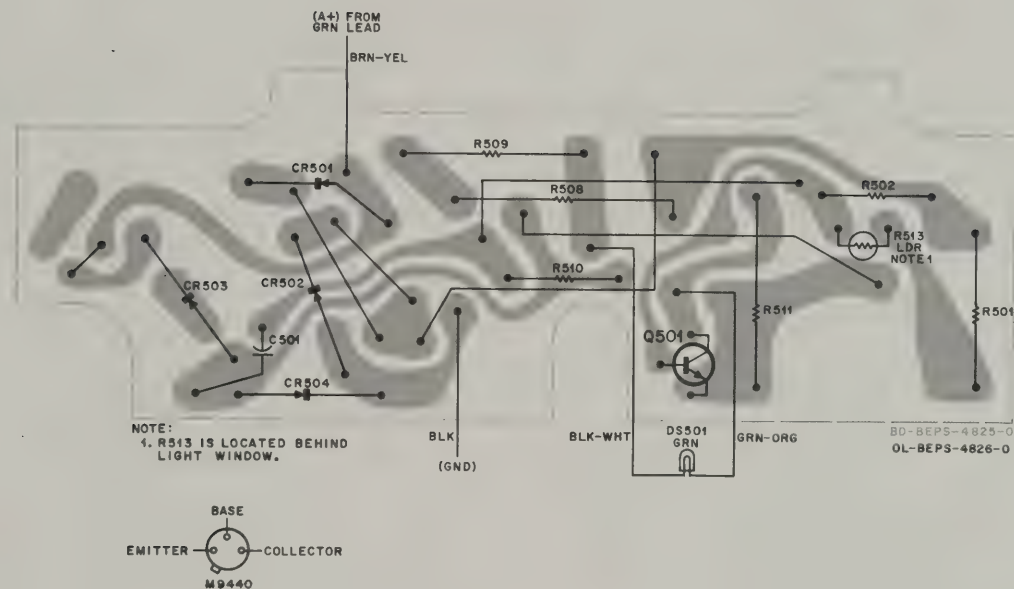
TRUNK-MOUNT, 2-FREQUENCY

TCN6026AF (Carrier Squelch)

TCN6026AH ("Private-Line" Tone-Coded Squelch)

PL-775-D

| | | |
|----------------------|--------------|---|
| DS501, 502 | 65K4151 | <u>LAMP, incandescent:</u> min. bay.; 6-8 V; 0.2 A; type No. 51 |
| J501 | 9K830418 | <u>CONNECTOR, receptacle:</u> female; 4-contact; does not include: 4S7699 LOCKWASHER; 13/16" internal; 2A482070 NUT, machine: ring type (knurled) |
| R501, 502 | 17C82350A04 | <u>RESISTOR, fixed: ±10%; 1/2 W:</u> unl stated |
| R503 | 18K857840 | 33 ±10%; 2 W |
| R504 | 6S5581 | variable: 25K ±30%; 0.33 W |
| R505 | 6S6320 | 3.3K |
| R506 | 18K868896 | 10K |
| | | variable: 25K ±30%; 0.33 W; |
| | | includes switch S501 |
| | | (TCN6026AH) |
| | or 18C857698 | variable: 25K ±30%; 0.33 W |
| R507 | 6S6336 | (TCN6026AF) |
| | | 270; 1 W |
| S501 | | <u>SWITCH:</u> |
| | or 40K80247 | dpst; p/o R506 (TCN6026AH) |
| S502, 503 | 40A80246 | toggle: dpst (TCN6026AF) |
| | | toggle: dpdt |
| TB501 | 31C83826D02 | <u>TERMINAL BOARD:</u> 35 female contacts |
| XDS501, 502 | 9B863168 | <u>LAMPHOLDER:</u> miniature bayonet type |
| NON-REFERENCED ITEMS | | |
| | 61B83678D01 | LENS, indicator light: RED |
| | 61B83678D02 | LENS, indicator light: GRN |
| | 3A82670A01 | SCREW, machine: special type; |
| | | 2 req'd (control head mounting) |
| | 36K858652 | KNOB, control: 2 req'd (VOL & SQ.) |
| | 3A82227A02 | SCREW, machine: special type; |
| | | 4 req'd. |
| | 15C82401D01 | COVER, housing: (back) |
| | 1V868494 | HOUSING, control head |
| | 13K857972 | ESCUTCHEON (TCN6026AF) |
| | 13K857976 | ESCUTCHEON (TCN6026AH) |
| | 7B82400D01 | BRACKET, control head |
| | | mounting |
| | 3S7302 | SCREW, machine: 10-32 x 3/8" |
| | | plain hex head; 2 req'd (for |
| | | mounting control head on |
| | | bracket) |
| | 3S7544 | SCREW, tapping: No. 8 x 1/2" |
| | | plain hex head; 3 req'd (for |
| | | mounting bracket) |

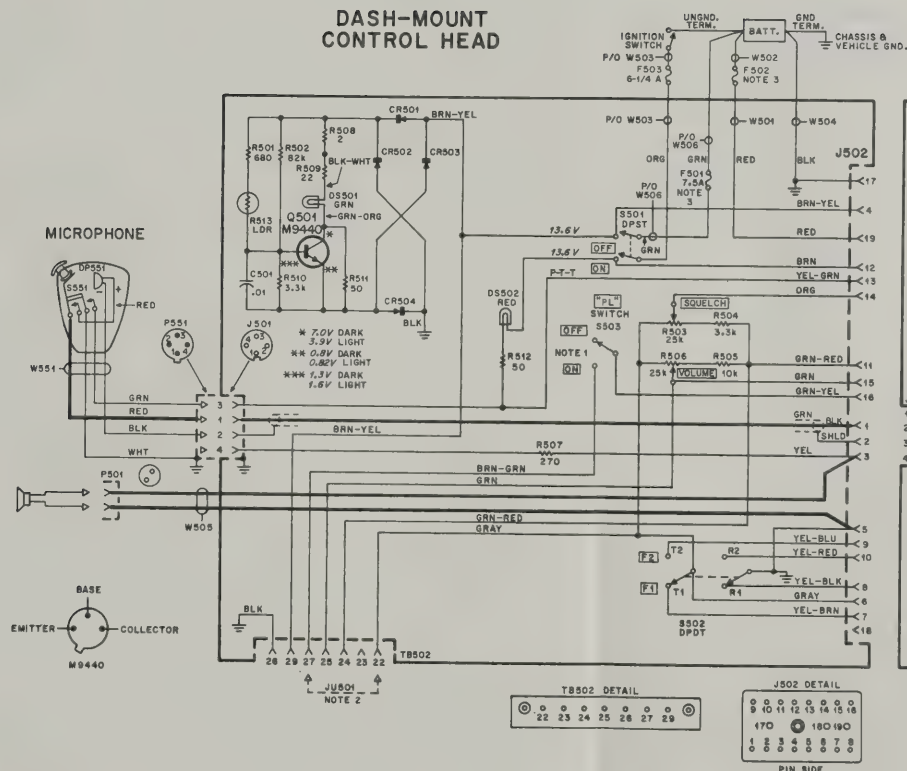


NOTES:

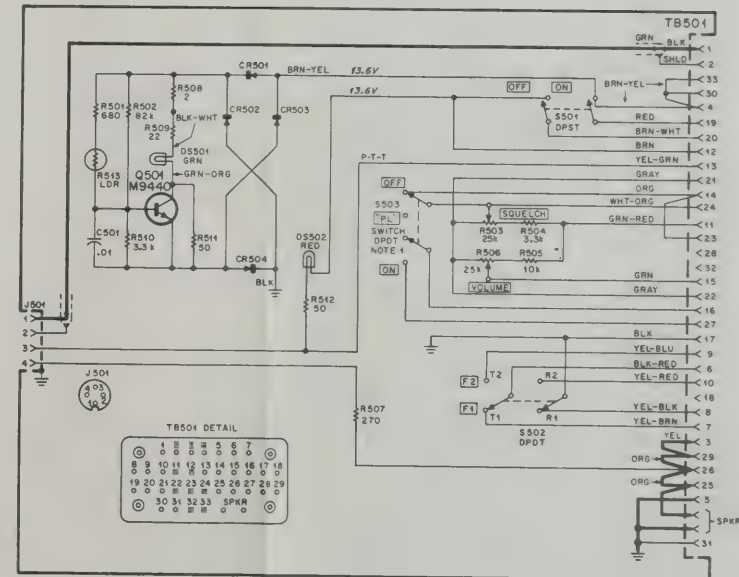
1. S503 AND ASSOCIATED WIRING USED IN "PRIVATE-LINE" MODELS ONLY.
2. JU501 USED IN "PRIVATE-LINE" MODELS ONLY.
3. DO NOT USE SLOW-BLOW FUSE.

EPS-4845-O

DASH-MOUNT CONTROL HEAD



TRUNK-MOUNT CONTROL HEAD



PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

Control Heads With Dimmer Used in
2-Frequency Radio Sets
Schematic Diagram & Circuit Board Detail
Motorola No. 63P81011E44-O
8/20/75-PO

| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|------------------|-------------------|-------------|
|------------------|-------------------|-------------|

PARTS LIST

CONTROL HEADS

DASH-MOUNT WITH DIMMER, 2-FREQUENCY

TCN6141AF (Carrier Squelch)
TCN6141AH ("Private-Line" Tone-Coded Squelch) PL-1195-O

| | | |
|----------------|-------------|--|
| C501 | 21D82428B62 | CAPACITOR, fixed: .01 uF +80-20%; 200 V |
| CR501 thru 504 | 48C82466H01 | SEMICONDUCTOR DEVICE, diode: (SEE NOTE) silicon |
| DS501, 502 | 6S4151 | LAMP, incandescent: min. bay: 6-8 V; 0.2 A; type No. 51 |
| F501 | 65K86099 | FUSE, cartridge: 1-1/4" x 1/4"; 32 V; |
| F502 | 65S8182 | 7.5 A |
| F503 | 65B475247 | 25 A 6-1/4 A |
| J501 | 9K830418 | CONNECTOR, receptacle: female: 4-cont; does not incl. 4S7699 LOCKWASHER; 13/16" internal, 2A482070 NUT, machine: ring type (knurled) female: 19 contact |
| J502 | 9C801050 | TRANSISTOR, (SEE NOTE) |
| Q501 | 48R869440 | N-P-N; type M9440 |
| R501 | 6S6040 | RESISTOR, fixed: ±10%; 1/2 W; unl. stated |
| R502 | 6S129145 | 680 |
| R503 | 18K857840 | 82k; 1/4 W |
| R504 | 6S5581 | var: 25k ±30%; 0.33 W |
| R505 | 6S6320 | 3.3k |
| R506 | 18K868896 | 10k var: 25k ±30%; 0.33 W; incl. switch S501 (TCN6141AH) |
| | or18C857698 | var: 25k ±30%; 0.33 W (TCN6141AF) |
| R507 | 6S6336 | 270; 1 W |
| R508 | 17C82036G03 | 2 ±5%; 3 W |
| R509 | 17D83122D09 | 22 ±5%; 3 W |
| R510 | 6S129231 | 3.3k; 1/4 W |
| R511 | 17C82291B15 | 50 ±5%; 3 W |
| R512 | 17D82177B05 | 50; 5 W |
| R513 | 6C83828D01 | light dependent type: 6.4k-10k @ 25°C |
| S501 | | SWITCH: dpst; p/o R506 (TCN6141AH) |
| S502, 503 | or40K80247 | toggle dpst (TCN6141AF) |
| S504 | 40A80246 | toggle: dpdt |
| | 40B83444D01 | slide: dpst |
| W501 | 1V80764A18 | CABLE ASSEMBLY, power: includes F501, XF501 and the following items: 10S345 CABLE power: no. 18 ga., str.; GRN: 107" length req'd. 29K865065 LUG, ring tongue |
| W502 | 1V80705A13 | incl. F502, XF502 and the following items: 30K813233 CABLE, power: No. 10 ga. str; RED: 9-1/2 ft. length req'd |
| W503 | 1V80705A06 | incl. F503, XF503 and the following items: 10M343 CABLE, power: No. 18 ga. str; ORG: 66" length req'd |
| W504 | 30K831572 | CABLE, power: No. 10 ga. str; BLK: 10 ft. length req'd |
| W505 | 30C82155H02 | 2-cond; each cond No. 18 ga. str; 36" length req'd |
| XDS501, 502 | 9B863168 | LAMPHOLDER: miniature bayonet type |

| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|------------------|-------------------|-------------|
|------------------|-------------------|-------------|

| | | |
|----------------------|---|---|
| XF501, 502 503 | | FUSEHOLDER: "in-line" type: c/o: 14A82882A01 BODY, 14A82883A02 CAP, 42A82884A01 CLIP, cont: 2 req'd. 41A82885A01 SPRING, compression |
| NON-REFERENCED ITEMS | | |
| | 61B83678D01 61B83678D02 3A82670A07 | LENS, indicator light: RED LENS, indicator light: GRN SCREW, machine: special type 2 req'd (control head mtg) |
| | 36B82629H02 26B83806D01 | KNOB, control: 3 req'd SHIELD, light: (for light dependent resistor located on "dimmer" board) |
| | 3A82227A02 | SCREW, machine: special type 4 req'd |
| | 1V80708B72 15D83576D07 13K857972 13K857976 1V80700B07 | COVER, housing: (back) HOUSING, control head ESCUTCHEON (TCN6141AF) ESCUTCHEON (TCN6141AH) LIGHT DIMMER BOARD (complete assembly) |

| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|------------------|-------------------|-------------|
|------------------|-------------------|-------------|

CONTROL HEADS

TRUNK-MOUNT WITH DIMMER, 2-FREQUENCY

TCN6098BF (Carrier Squelch)
TCN6098BH ("Private-Line" Tone-Coded Squelch)
TCN6136AF (Carrier Squelch)
TCN6136AH ("Private-Line" Tone-Coded Squelch) PL-1190-O

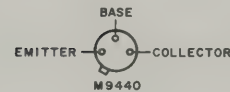
| | | |
|----------------------|--|---|
| C501 | 21D82428B62 | CAPACITOR, fixed: .01 uF +80-20%; 200 V |
| CR501 thru 504 | 48C82466H01 | SEMICONDUCTOR DEVICE, diode: (SEE NOTE) silicon |
| DS501, 502 | 6S4151 | LAMP, incandescent: min. bay: 6-8 V; 0.2 A; type No. 51 |
| J501 | 9K830418 | CONNECTOR, receptacle: female: 4-cont; does not incl. 4S7699 LOCKWASHER; 13/16" internal, 2A482070 NUT, machine: ring type (knurled) |
| Q501 | 48R869440 | TRANSISTOR, (SEE NOTE) N-P-N; type M9440 |
| R501 | 6S6040 | RESISTOR, fixed: ±10%; 1/2 W; unl. stated |
| R502 | 6S129145 | 680 |
| R503 | 18K857840 | 82k; 1/4 W |
| R504 | 6S5581 | var: 25k ±30%; 0.33 W |
| R505 | 6S6320 | 3.3k |
| R506 | 18K868896 | 10k var: 25k ±30%; 0.33 W; incl. switch S501 (TCN6098BH, TCN6136AH) |
| | or18C857698 | var: 25k ±30%; 0.33 W (TCN6098BF, TCN6136AF) |
| R507 | 6S6336 | 270; 1 W |
| R508 | 17C82036G03 | 2 ±5%; 3 W |
| R509 | 17D83122D09 | 22 ±5%; 3 W |
| R510 | 6S129231 | 3.3k; 1/4 W |
| R511 | 17C82291B15 | 50 ±5%; 3 W |
| R512 | 17D82177B05 | 50; 5 W |
| R513 | 6C83828D01 | light dependent type: 6.4k-10k @ 25°C |
| S501 | | SWITCH: dpst; p/o R506 (TCN6098BH, TCN6136AH) |
| | or40K80247 | toggle: dpst (TCN6098BF, TCN6136AF) |
| S502, 503 | 40A80246 | toggle: dpdt |
| S504 | 40B83444D01 | slide: dpst |
| TB501 | 31C83826D01 | TERMINAL BOARD: 35 female contacts |
| XDS501, 502 | 9B863168 | LAMPHOLDER: miniature bayonet type |
| NON-REFERENCED ITEMS | | |
| | 61B83678D01 61B83678D02 3A82670A01 | LENS, indicator light: RED LENS, indicator light: GRN SCREW, machine: special type 2 req'd (control head mtg) |
| | 36K858652 | KNOB, control: 2 req'd (VOL & SQUELCH) |
| | 26B83806D01 | SHIELD, light: (for light-dependent resistor located on "dimmer" board) |
| | 3A82227A02 | SCREW, machine: special type 4 req'd |
| | 15C82401D01 15D83576D03 13K857972 13K857976 13C84067B02 13C84067B01 | COVER, housing: (back) HOUSING, control head ESCUTCHEON (TCN6098BF) ESCUTCHEON (TCN6098BH) ESCUTCHEON (TCN6136AF) ESCUTCHEON (TCN6136AH) |

| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|------------------|-------------------|-------------|
|------------------|-------------------|-------------|

| | | |
|--|----------------------|--|
| | 7B82400D01 3S7302 | BRACKET, control head mtg + SCREW, machine: 10-32 x 3/8" plain hex head; 2 req'd (for mtg control head on bracket) |
| | 3S7544 | SCREW, tapping: No. 8 x 1/2" plain hex head; 3 req'd (for mtg bracket) |
| | 1V80700B07 | LIGHT DIMMER BOARD (Complete assembly) |

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.



1. S503 AND ASSOCIATED WIRING USED IN "PRIVATE-LINE" MODELS ONLY.
2. J8501 USED IN "PRIVATE-LINE" MODELS ONLY.
3. DO NOT USE SLOW-BLOW FUSE
4. S502 AND ASSOCIATED WIRING USED IN MULTIPLE FREQUENCY MODEL ONLY.

J502 DETAIL

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | | | | | 18 | 19 | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

PIN SIDE



Control Heads With Dimmer Used in
1- & 4-Frequency Radio Sets
Schematic Diagram & Circuit Board Detail
Motorola No. 63P81011E57-O
8/20/75-PO

| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|------------------|-------------------|-------------|
|------------------|-------------------|-------------|

PARTS LIST

CONTROL HEADS

WITH DIMMER
DASH-MOUNT 1-FREQ. & 4-FREQ.

TCN6141AE (Carrier Squelch, 1-Freq.)

TCN6141AG ("Private-Line" Tone-Coded Squelch, 1-Freq.)

TCN6141AJ (Carrier Squelch, 4-Freq.)

TCN6141AK ("Private-Line" Tone-Coded Squelch, 4-Freq.)

PL-1193-O

| | | |
|--|---|---|
| C501 | 21D82428B62 | CAPACITOR, fixed: 01 uF +80-20%; 200 V |
| CR501 thru 504 | 48C82466H01 | SEMICONDUCTOR DEVICE, diode: (SEE NOTE) silicon |
| DS501, 502 | 6S4151 | LAMP, incandescent: min. bay.: 6-8 V; 9.2 A; type No. 51 |
| F501 F502 F503 | 65K86099 65S61682 65B475247 | FUSE, cartridge: 1-1/4" x 1/4" 32 V; 7.5 A 25 A 6-1/4 A |
| J501 | 9K830418 | CONNECTOR, receptacle: female: 4-contact; does not include: 4S7699 LOCKWASHER; 13/16" internal 2A482070 NUT, machine; ring type (knurled) female: 19-contact |
| J502 | 9C801050 | |
| P501 | 9B851112 | CONNECTOR, plug: female: 2-contact; does not include 15B851111 SHELL, connector |
| Q501 | 48R869440 | TRANSISTOR: (SEE NOTE) N-P-N; type M9440 |
| R501 R502 R503 R504 R505 R506 | 6S6040 6S129145 18K857840 6S5581 6S6320 18K868896 | RESISTOR, fixed: ±10%; 1/2 W; unl. stated 680 82k; 1/4 W variable: 25k ±30%; 0.33 W 3.3k 10k variable: 25k ±30%; 0.33 W; includes switch S501 (TCN6141AE, AJ) variable: 25k ±30%; 0.33 W (TCN6141AG, AK) |
| R507 R508 R509 R510 R511 R512 R513 | or18C857698 6S6336 17C82036G03 17D83122D09 6S129231 17C82291B15 17D82177B05 6C83828D01 | 270; 1 W 2 ±5%; 3 W 22 ±5%; 3 W 3.3k; 1/4 W 50 ±5%; 3 W 50; 5 W light dependent type; 6.4k-10k @ 25°C |
| S501 | or40K80247 | SWITCH: dpst; p/o R506 (TCN6141AE, AJ) toggle dpst (TCN6141AG, AK) |
| S502 | 40C83624D01 | rotary; 1-pole; 4-position; non-shorting toggle: dpdt |
| S503 | 40A80246 | |
| W501 | 1V80764A18 | CABLE ASSEMBLY, power: includes F501, XF501 and the following items: 10S345 CABLE, power; No. 18 ga., str.: GRN; 107" length req'd; 29K865065 LUG, ring- tongue |
| W502 | 1V80705A13 | includes F502, XF502 and the following items: 30K813233 CABLE, power; No. 10 ga., str.: RED; 9-1/2 ft. length req'd. |

| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|------------------|-------------------|-------------|
|------------------|-------------------|-------------|

| | | |
|----------------------|---|--|
| W503 | 1V80705A06 | includes F503, XF503 and the following items: 10M343 CABLE, power; No. 18 ga., str.: ORG; 66" length req'd |
| W504 | 30K831572 | CABLE, power: No. 10 ga., str.: BLK; 10 ft. length req'd. |
| W505 | 30C83155H02 | 2-conductor; each conductor No. 18 ga., str.: 36" length req'd. |
| XDS501, 502 | 9B863168 | LAMPHOLDER: miniature bayonet type |
| XF501, 502, 503 | | FUSEHOLDER: "in-line" type; consists of: 14A82882A01 BODY 14A82883A02 CAP 42A82884A01 CLIP, contact: 2 req'd.; 41A82885A01 SPRING, compression |
| NON-REFERENCED ITEMS | | |
| | 61B83678D01 61B83678D02 3A82670A07 | LENS, indicator light: RED LENS, indicator light: GRN SCREW, machine: special type; 2 req'd. (control head mounting) |
| | 36B82629H02 | KNOB, control: (2 req'd for TCN6141AE, AG; 3 req'd. for TCN6141AJ, AK) |
| | 26B83806D01 | SHIELD, light: (for light- dependent resistor located on "dimmer" board) |
| | 3A82227A02 | SCREW, machine: special type 4 req'd. |
| | 1V80708B72 15D83576D07 13D857971 13D857975 13D82286C23 13D82286C22 1V80700B07 | COVER, housing: (back) HOUSING, control head ESCUTCHEON (TCN6141AE) ESCUTCHEON (TCN6141AG) ESCUTCHEON (TCN6141AJ) ESCUTCHEON (TCN6141AK) LIGHT DIMMER BOARD (complete assembly) |

CONTROL HEADS

WITH DIMMER
TRUNK-MOUNT 1-FREQ. & 4-FREQ.

TCN6098BE (Carrier Squelch, 1-Freq.)

TCN6098BG ("Private-Line" Tone-Coded Squelch, 1-Freq.)

TCN6098BJ (Carrier Squelch, 4-Freq.)

TCN6098BK ("Private-Line" Tone-Coded Squelch, 4-Freq.)

PL-1194-O

| | | |
|--|---|---|
| C501 | 21D82428B62 | CAPACITOR, fixed: 01 uF +80-20%; 200 V |
| CR501 thru 504 | 48C82466H01 | SEMICONDUCTOR DEVICE, diode: (SEE NOTE) silicon |
| DS501, 502 | 6S4151 | LAMP, incandescent: min. bay.: 6-8 V; 0.2 A; type No. 51 |
| J501 | 9K830418 | CONNECTOR, receptacle: female: 4-contact; does not include: 4S7699 LOCKWASHER; 13/16" internal: 2A482070 NUT, machine; ring type (knurled) |
| Q501 | 48R869440 | TRANSISTOR: (SEE NOTE) N-P-N; type M9440 |
| R501 R502 R503 R504 R505 R506 | 6S6040 6S129145 18K857840 6S5581 6S6320 18K868896 | RESISTOR, fixed: ±10%; 1/2 W; unl. stated 680 82k; 1/4 W variable: 25k ±30%; 0.33 W 3.3k 10k variable: 25k ±30%; 0.33 W; includes switch S501 (TCN6098BE, BJ) variable: 25k ±30%; 0.33 W (TCN6098BG, BK) |
| R507 R508 R509 R510 R511 R512 R513 | or18C857698 6S6336 17C82036G03 17D83122D09 6S129231 17C82291B15 17D82177B05 6C83828D01 | 270; 1 W 2 ±5%; 3 W 22 ±5%; 3 W 3.3k; 1/4 W 50 ±5%; 3 W 50; 5 W light dependent type; 6.4k-10k @ 25°C |
| S501 | or40K80247 | SWITCH: dpst; p/o R506 (TCN6098BE, BJ) toggle dpst (TCN6098BG, BK) |
| S502 | 40C83624D01 | rotary; 1-pole; 4-position; non-shorting toggle: dpdt |
| S503 | 40A80246 | |
| TB501 | 31C83826D01 | TERMINAL BOARD: 35 female contacts |
| XDS501, 502 | 9B863168 | LAMPHOLDER: miniature bayonet type |
| NON-REFERENCED ITEMS | | |
| | 61B83678D01 61B83678D02 3A82670A01 | LENS, indicator light: RED LENS, indicator light: GRN SCREW, machine: special type; 2 req'd. (control head mounting) |
| | 36K858652 | KNOB, control: 2 req'd. (VOL & SQ.) |
| | 36B82869D01 26B83806D01 | KNOB, control: (freq. selector) SHIELD, light: (for light- dependent resistor located on "dimmer" board) |
| | 3A82227A02 | SCREW, machine: special type; 4 req'd. |
| | 15C82401D01 15D83576D03 13D857971 13D857975 13D82286C23 | COVER, housing: (back) HOUSING, control head ESCUTCHEON (TCN6098BE) ESCUTCHEON (TCN6098BG) ESCUTCHEON (TCN6098BJ) |

| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|------------------|-------------------|-------------|
|------------------|-------------------|-------------|

| | | |
|--|---------------------------|--|
| | 13D82286C22 7B82400D01 | ESCUTCHEON (TCN6098BK) BRACKET, control head mounting |
| | 3S7302 | SCREW, machine: 10-32 x 3/8" plain hex head; 2 req'd (for mounting control head on bracket) |
| | 3S7544 | SCREW, tapping: No. 8 x 1/2" plain hex head; 3 req'd. (for mounting bracket) |
| | 1V80700B07 | LIGHT DIMMER BOARD (complete assembly) |

NOTE:

Replacement diodes and transistors must be ordered by
Motorola part number only for optimum performance.

MICROPHONE



49

| REVISONS | | | | PEPS-5652-D |
|---|-------------|-------------------|----------|-------------|
| CHASSIS AND SUFFIX NO. | REF. SYMBOL | CHANGE | LOCATION | |
| TCN6141BE-1 TCN6141BF-1 TCN6141BJ-1 | CR505 | Added 48-83461E45 | TB501-12 | |

PARTS LIST

CONTROL HEADS

WITH DIMMER
DASH-MOUNT
1-FREQ. & 4-FREQ.

TCN6141BE (Dual Purpose, 1-Freq.)
TCN6141BJ (Dual Purpose, 4-Freq.)

PL-1321-A

| | | |
|------------------------------|--|---|
| CR505 | 48-83461E45 | SEMICONDUCTOR DEVICE, diode: (SEE NOTE) dual Zener type: 25 V |
| DS501, 502 | 6S4151 | LAMP, incandescent; min. bay: 6-8 V; 0.2 A; type No. 51 FUSE, cartridge: 1-1/4" x 1/4"; 32 V; 7.5 A 25 A 6-1/4 A |
| F501 F502 F503 | 65K86099 65S61682 65B475247 | FUSE, cartridge: 1-1/4" x 1/4"; 32 V; 7.5 A 25 A 6-1/4 A |
| J501 | 9K830418 | CONNECTOR, receptacle; female: 4 contact; does not include: 4S7699 LOCKWASHER; 13/16" internal 2A482070 NUT, machine: ring type (knurled) female: 19-contact |
| J502 | 9C801050 | CONNECTOR, plug; female: 2-contact; does not include 15B855111 SHELL, connector |
| P501 | 9B855112 | CONNECTOR, plug; female: 2-contact; does not include 15B855111 SHELL, connector |
| R503 R504 R505 R506 | 18K857840 6S5581 6S6320 18K868896 | RESISTOR, fixed: ±10%; 1/2 W; unl stated var: 25k ±30%; 0.33 W 3.3k 10k variable: 25k ±30%; 0.33 W; includes switch S501 270; 1 W 50; 5 W |
| R507 R512 | 6S6336 17D82177B05 | RESISTOR, fixed: ±10%; 1/2 W; unl stated var: 25k ±30%; 0.33 W 3.3k 10k variable: 25k ±30%; 0.33 W; includes switch S501 270; 1 W 50; 5 W |
| S501 S502 | 40C83624D01 | SWITCH; dpst; p/o R506 rotary: 1-pole; 4-position non-shorting (TCN6141BJ) |
| TB502 | 31C84922A01 | BOARD, terminal; 7 terminal |
| W501 | 1V80764A18 | CABLE ASSEMBLY, power; includes F501, XF501 and the following items: 10S345 CABLE, power: No. 18 ga., str.; GRN: 107" length req'd; 29K865065 LUG, ring-tongue includes F502, XF502 and the following items: 30K813233 CABLE, power: No. 10 ga., str.; RED: 9-1/2 ft. length req'd includes F503, XF503 and the following items: 10M343 CABLE, power: No. 18 ga., str.: ORG: 66" length req'd |
| W502 | 1V80705A13 | CABLE ASSEMBLY, power; includes F501, XF501 and the following items: 10S345 CABLE, power: No. 18 ga., str.; GRN: 107" length req'd; 29K865065 LUG, ring-tongue includes F502, XF502 and the following items: 30K813233 CABLE, power: No. 10 ga., str.; RED: 9-1/2 ft. length req'd includes F503, XF503 and the following items: 10M343 CABLE, power: No. 18 ga., str.: ORG: 66" length req'd |
| W503 | 1V80705A06 | CABLE ASSEMBLY, power; includes F501, XF501 and the following items: 10S345 CABLE, power: No. 18 ga., str.; GRN: 107" length req'd; 29K865065 LUG, ring-tongue includes F502, XF502 and the following items: 30K813233 CABLE, power: No. 10 ga., str.; RED: 9-1/2 ft. length req'd includes F503, XF503 and the following items: 10M343 CABLE, power: No. 18 ga., str.: ORG: 66" length req'd |
| W504 | 30K831572 | CABLE, power; No. 10 ga., str.; BLK: 10 ft. length req'd. |
| W505 | 30C83155H02 | 2-conductor; each conductor No. 18 ga., str.: 36" length req'd |
| XDS501, 502 | 9B863168 | LAMPHOLDER; miniature bayonet type |

PL-1321-A

| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|------------------|-------------------|-------------|
|------------------|-------------------|-------------|

| | | |
|---|--|---|
| XF501, 502, 503 | | FUSEHOLDER; "in-line" type; consists of: 14A82882A01 BODY 14A82883A02 CAP 42A82884A01 CLIP, contact: 2 req'd; 41A82885A01 SPRING, compression |
| NON-REFERENCED ITEMS | | |
| 61B83678D01 61B83678D02 3A82670A07 | LENS, indicator light: RED LENS, indicator light: GRN SCREW, machine: special type: 2 req'd (control head mounting) | |
| 36B82629H02 | KNOB, control: (2 req'd for TCN6141BE; 3 req'd for TCN6141BJ) | |
| 26B83806D01 | SHIELD, light: (for light- dependent resistor located on "dimmer" board) | |
| 3A82227A02 | SCREW, machine: special type: 4 req'd | |
| 1V80708B72 15D83576D07 13D857971 13D82286C23 3B82126B07 | COVER, housing: (back) HOUSING, control head ESCUTCHEON (TCN6141BE) ESCUTCHEON (TCN6141BJ) SCREW, nylon: 4-40 x 1/4" | |

MICROPHONE

TMN6013A Microphone
TMN6018A Microphone Weatherproof

PL-924-C

| | | |
|---------------------------------------|--|---|
| DP551 | 59-82933C01 or 59-82933C02 | CARTRIDGE, microphone; transistor amplifier |
| P551 | 28-16370 | CONNECTOR, plug; male: 4 contact |
| S551 | 40-82263G02 (TMN6013A) or 40-82263G01 (TMN6018A) | SWITCH, push; dpst not replaceable; in TMN6018A: P/O W601 |
| W551 | 1-80707A58 (TMN6013A) or 1-80724A28 (TMN6018A) | CORD, microphone; assembly; includes P551 and the following items: 41-852707 SPRING, strain relief 29-847034 LUG, insulation- piercing; 4 required CORD, PLUG & SWITCH ASSY. includes P551, S551 |
| NON-REFERENCED ITEMS | | |
| 1-80720A94 | CASE, microphone; includes hang-up stud | |
| 11-2506 | TUBING; No. 9 BLK, 5" length required | |
| 3-124693 | LOCKSCREW: 6-32 x 1/4" Phillips round head; 2 required | |
| 42-852710 38-852699 15-82701B01 | STRAP, strain relief PUSHBUTTON COVER, microphone case (front) | |
| 32-82703B01 4-114201 | GASKET: neoprene WASHER: 1/4" x 0.156" x .015 3 required | |
| 3-127924 | LOCKSCREW: 6-32 x 5/16" Phillips round head | |
| 3-132436 | SCREW, machine: 6-32 x 13/16" Phillips round head 3 required | |
| 42-82702B01 1-865398 | RETAINER, mic, cartridge MOUNTING KIT, microphone includes 64-85596 PLATE mic, hang-up; 3-122830 SCREW, tapping: No. 8 x 1/2" slotted binder head; 2 required | |

| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|------------------|-------------------|-------------|
|------------------|-------------------|-------------|

PARTS LIST

CONTROL HEADS

DASH MOUNT WITH DIMMER, 2-FREQUENCY

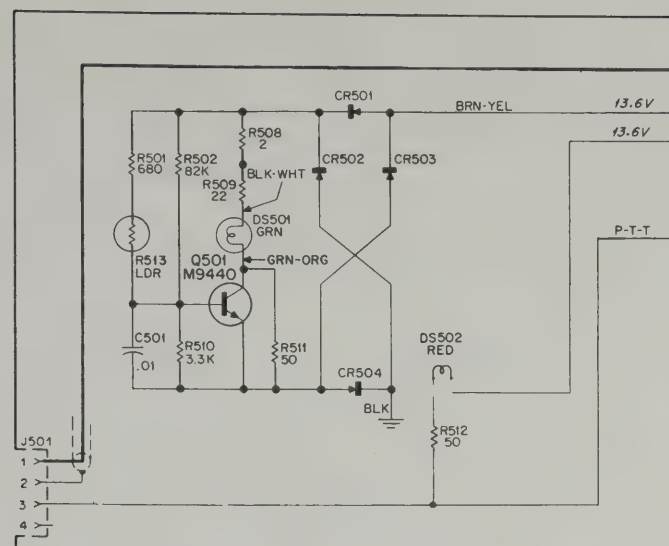
TCN6141BF (Dual Purpose) PL-1322-A

| | | |
|--|---|--|
| CR505 | 48-83461E45 | SEMICONDUCTOR DEVICE, diode: (SEE NOTE) dual Zener type: 25 V |
| DS501, 502 | 6S4151 | LAMP, incandescent; min. bay: 6-8 V; 0.2 A; type No. 51 FUSE, cartridge: 1-1/4" x 1/4"; 32 V; 7.5 A 25 A 6-1/4 A |
| F501 F502 F503 | 65K86099 65S61682 65B475247 | FUSE, cartridge: 1-1/4" x 1/4"; 32 V; 7.5 A 25 A 6-1/4 A |
| J501 | 9K830418 | CONNECTOR, receptacle; female: 4-cont; does not incl 4S7699 LOCKWASHER: 13/16" internal, 2A482070 NUT, machine: ring type (knurled) female: 19-contact |
| J502 | 9C801050 | CONNECTOR, plug; incl: 9B855112 CONNECTOR, plug and 15B855111 COVER, connector |
| P501 | | CONNECTOR, plug; incl: 9B855112 CONNECTOR, plug and 15B855111 COVER, connector |
| R503 R504 R505 R506 R507 R512 | 18K857840 6S5581 6S6320 18C857698 6S6336 17D82177B05 | RESISTOR, fixed: ±10%; 1/2 W; unl stated var: 25k ±30%; 0.33 W 3.3k 10k var: 25k ±30%; 0.33 W 270; 1 W 50; 5 W |
| S501 S502 | 40K80247 40A80246 | SWITCH; toggle: dpst toggle: dpdt |
| TB502 | 31C84922A01 | BOARD, terminal; 7 terminal |
| W501 | 1V80764A18 | CABLE ASSEMBLY, power; incl F501, XF501 and the follow- ing items: 10S345 CABLE, power: No. 18 ga., str.; GRN: 107" length req'd 29K865065 LUG, ring tongue |
| W502 | 1V80705A13 | incl F502, XF502 and the follow- ing items: 30K813233 CABLE, power: No. 10 ga, str: RED: 9-1/2 ft length req'd |
| W503 | 1V80705A06 | incl F503, XF503 and the follow- ing items: 10M343 CABLE, power: No. 18 ga, str: ORG: 66" length req'd |
| W504 | 30K831572 | CABLE, power; No. 10 ga, str; BLK: 10 ft. length req'd |
| W505 | 30C82155H02 | 2-cond; each cond. No. 18 ga, str: 36" length req'd |
| XDS501, 502 | 9B863168 | LAMPHOLDER; miniature bayonet type |
| XF501, 502, 503 | | FUSEHOLDER; "in-line" type: c/o; 14A82882A01 BODY 14A82883A02 CAP 42A82884A01 CLIP, cont: 2 req'd, 41A82885A01 SPRING, compression |

| REFERENCE SYMBOL | MOTOROLA PART NO | DESCRIPTION |
|------------------|------------------|-------------|
|------------------|------------------|-------------|

NON-REFERENCED ITEMS

| | |
|--|---|
| 61B83678D01 61B83678D02 3A82670A07 | LENS, indicator light: RED LENS, indicator light: GRN SCREW, machine: special type: 2 req'd (control heat mtg) |
| 36B82629H02 26B83806D01 | KNOB, control: 3 req'd SHIELD, light: (for light de- pendent resistor located on "dimmer" board) |
| 3A82227A02 | SCREW, machine: special type; 4 req'd |
| 1V80708B72 15D83576D07 13K857972 3B82126B07 | COVER, housing: (back) HOUSING, control head ESCUTCHEON SCREW, nylon: 4-40 x 1/4" |



| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|------------------|-------------------|-------------|
|------------------|-------------------|-------------|

PARTS LIST

PILOT LIGHT DIMMER BOARD

1V80700B07 Light Dimmer Board

PL-151-A

| | | |
|---------------------|-------------|---|
| C501 | 21D82428B62 | CAPACITOR, fixed: .01 uF +80-20%; 200 V |
| CR501 thru 504 | 48C82466H01 | SEMICONDUCTOR DEVICE, diode: (SEE NOTE) silicon |
| Q501 | 48R869440 | TRANSISTOR, N-P-N; type M9440 |
| R501 | 6S6040 | RESISTOR, fixed: 680 ±10%; 1/2 W |
| R502 | 6S129145 | 82K ±10%; 1/4 W |
| R508 | 17C82036G03 | 2 ±5%; 3 W |
| R509 | 17D83122D09 | 22 ±5%; 3 W |
| R510 | 6S129231 | 3.3K ±10%; 1/4 W |
| R511 | 17C82291B15 | 50 ±5%; 3 W |
| R513 | 6C83828D01 | light dependent type; 6.4K-10K @ 25°C |
| NON-REFERENCED ITEM | | |
| | 1V80765A48 | CIRCUIT BOARD ASSY. (less components) |

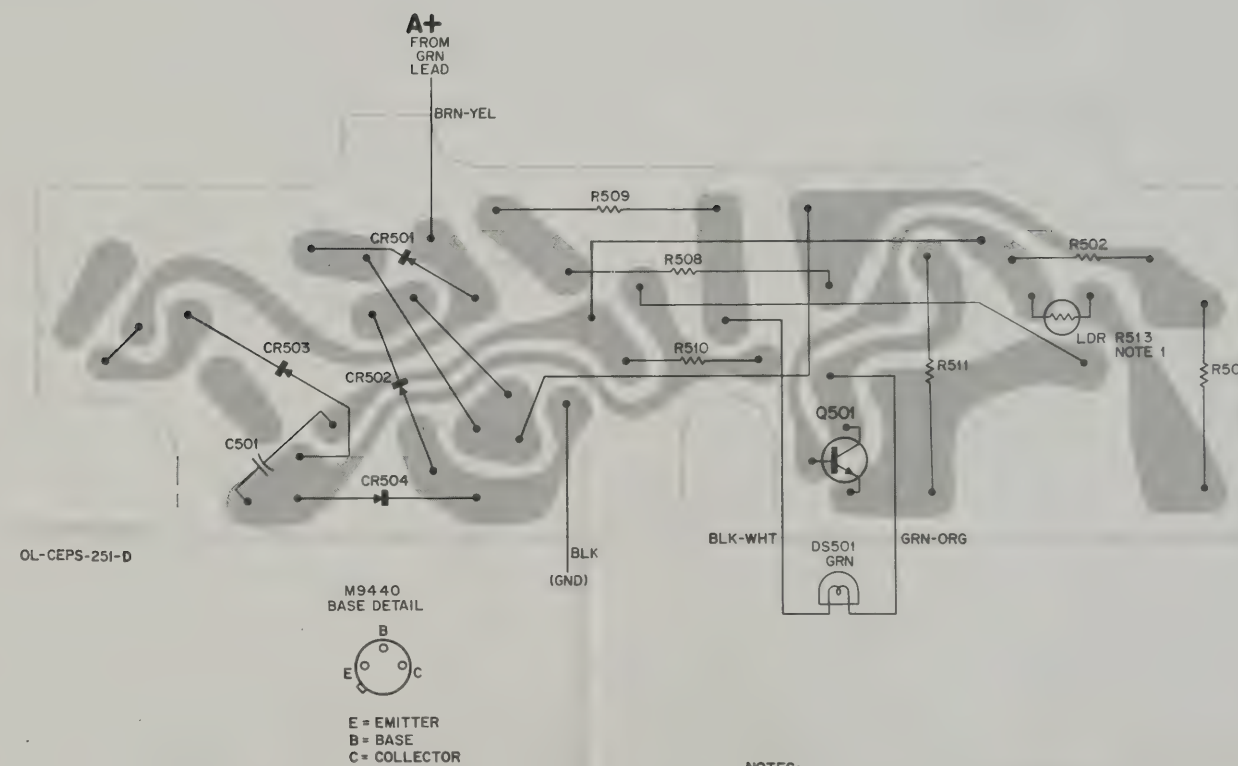
NOTE:

Replacement diodes must be ordered by Motorola part number only for optimum performance.

REVISIONS

PEPS-250-F

| CHASSIS AND SUFFIX NO. | REF. SYMBOL | CHANGE | LOCATION |
|------------------------|-------------|---------------|----------|
| | | NOTES REVISED | |

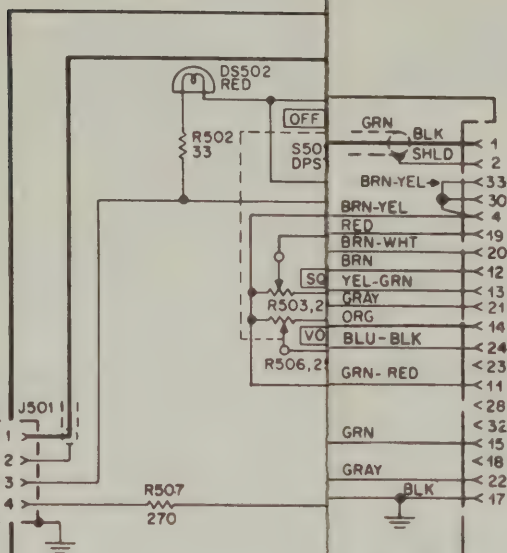
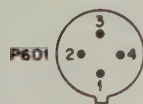
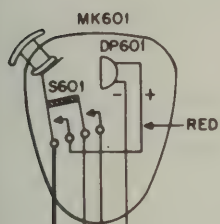


NOTES:

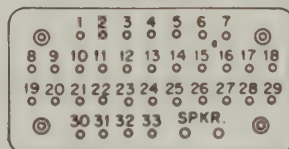
1. R513 IS LOCATED BEHIND LIGHT WINDOW.

Pilot Light Dimmer Circuit Board Detail
Motorola No. PEPS-250-F
8/20/75-PO

MICROPHONE



TB501 DETAIL

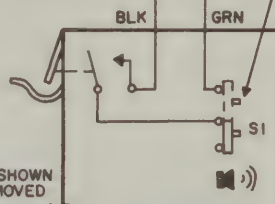


* S502 AND A
USED IN MUL
RADIOS ONLY

TB501

HOOKSWITCH SHOWN
WITH MIC REMOVED
(MONITOR POSITION)

SI MONITOR OPERATE
(SWITCH SHOWN IN
MONITOR POSITION)



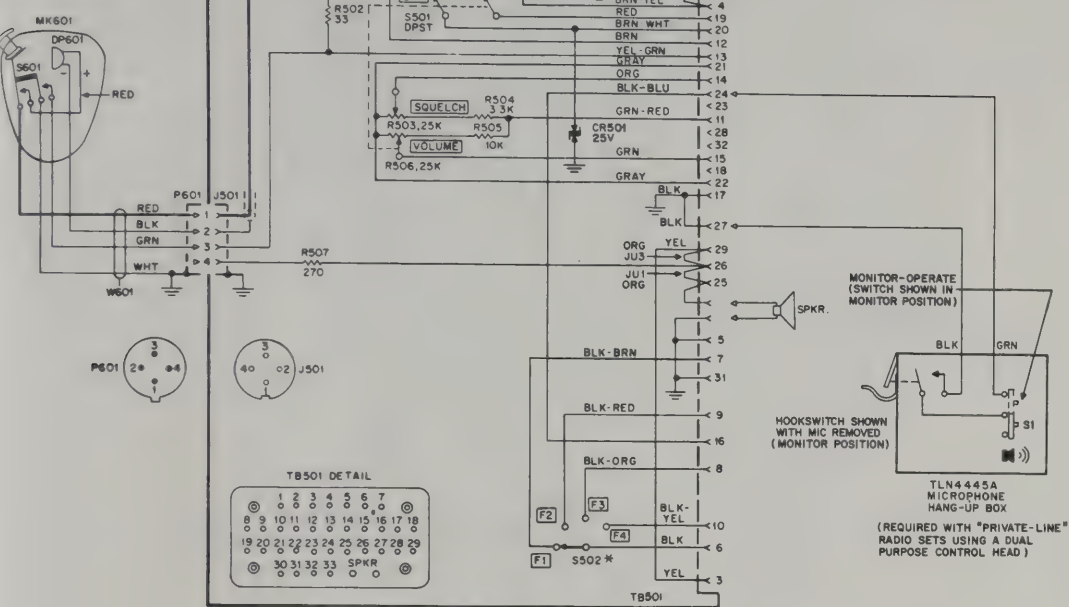
TLN 4445A
MICROPHONE
HANG UP BOX
(REQUIRED WITH "PRIVATE-LINE"
RADIO SETS USING A DUAL
PURPOSE CONTROL HEAD)

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

Trunk Mount Dual-Purpose
Control Heads and Cabling
Schematic Diagram
Motorola No. PEPS-5653-C
8/20/75-PO

TRUNK MOUNT DUAL PURPOSE CONTROL HEAD TCN6025BJ-1

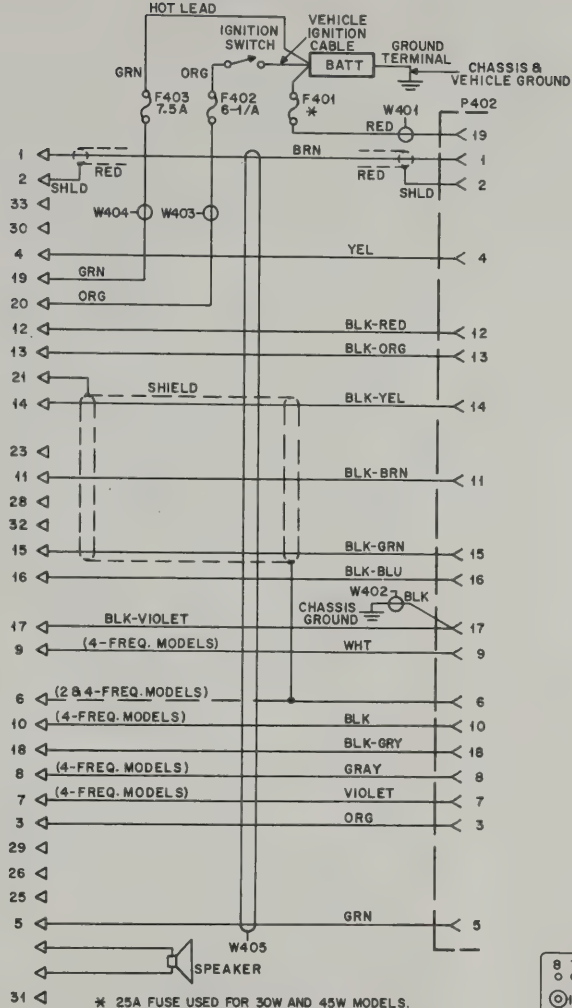
MICROPHONE



* S502 AND ASSOCIATED WIRING
USED IN MULTI-FREQUENCY
RADIOS ONLY.

CEPS-5373-D

TRUNK MOUNT CABLING



* 25A FUSE USED FOR 30W AND 45W MODELS.
FOR HIGHER POWER MODELS USE 40A FUSE.

CEPS-5089-C

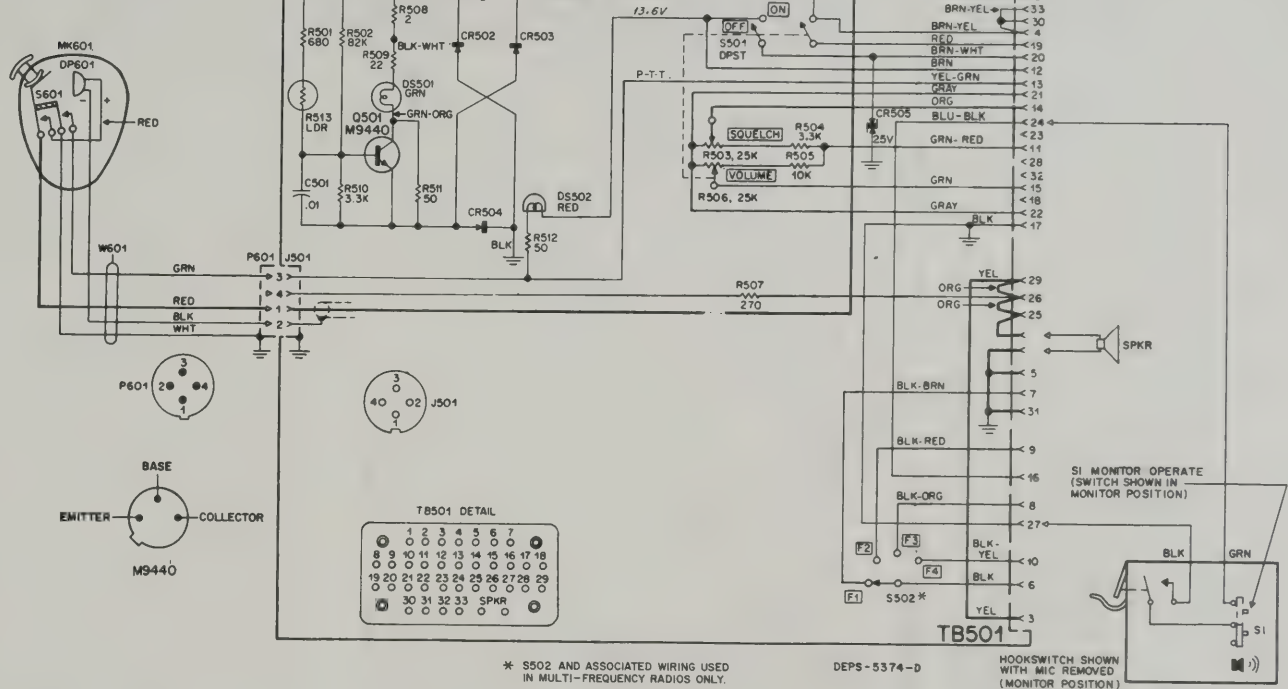
NOTES:

1. NO ELECTRICAL CONNECTION.
2. NO ELECTRICAL CONNECTION ON CARRIER SQUELCH MODELS.
3. NO ELECTRICAL CONNECTION ON 1-FREQUENCY MODELS.
4. S502 USED IN MULTI-FREQUENCY RADIOS ONLY.

CEPS-5372-O

TRUNK MOUNT DUAL PURPOSE CONTROL HEAD (WITH DIMMER) TCN6098CJ-1

MICROPHONE



* S502 AND ASSOCIATED WIRING
USED IN MULTI-FREQUENCY
RADIOS ONLY.

DEPS-5374-D

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

Trunk Mount Dual-Purpose
Control Heads and Cabling
Schematic Diagram
Motorola No. PEPS-5653-C
8/20/75-PO

| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|------------------|-------------------|-------------|
|------------------|-------------------|-------------|

PARTS LIST

IMPORTANT
USE ONLY THE FOLLOWING MOTOROLA PART NUMBERS WHEN ORDERING REPLACEMENT PARTS

TCN6098CE Control Head, Trunk Mount 1-Freq.
Dual Purpose with Dimmer
TCN6098CF Control Head, Trunk Mount 2-Freq.
Dual Purpose with Dimmer PL-1274-A

| | | |
|----------------------|-------------|--|
| CR505 | 48-83461E45 | SEMICONDUCTOR DEVICE, diode; (SEE NOTE) dual Zener type; 25 V |
| DS501, 502 | 65S4151 | LAMP, incandescent; min. bay; 6-8 V; 0.2 A; type No. 51 |
| J501 | 9K830418 | CONNECTOR, receptacle; female; 4 contact; does not incl. 457699 LOCKWASHER; 13/16" internal 2A482070 NUT, machine ring (knurled) |
| R503 | 18K857840 | RESISTOR, fixed; $\pm 10\%$; 1/4 W; unl. stated |
| R504 | 6R5581 | variable; 25k $\pm 30\%$; 0.33 W |
| R505 | 6R6320 | 10k; 1/2 W |
| R506 | 18K868896 | variable; 25k $\pm 30\%$; 0.33 W; includes SWITCH, toggle; dpst (1-freq) |
| or18C857698 | | variable; 25k $\pm 30\%$; 0.33 W (2-freq) |
| R507 | 6S6336 | 270; 1 W |
| R512 | 17D82177B05 | 50; 5 W |
| S501 | or40K80247 | SWITCH, toggle; p/o R506 (1-freq) |
| S502 | 40A80246 | toggle; dpst (2-freq) |
| or40K80247 | | toggle; dpdt |
| TB501 | 31C83826D01 | TERMINAL BOARD; 35 female contact |
| XDS501, 502 | 9B863168 | LAMPHOLDER; min. bay. |
| NON-REFERENCED ITEMS | | |
| 26B83806D01 | | SHIELD, light (for R513) |
| 61B83678D01 | | LENS, indicator; light; RED |
| 61B83678D02 | | LENS, indicator; light; GRN |
| 3A82670A01 | | SCREW, control head mounting 2 req'd |
| 36K858652 | | KNOB, control; 2 req'd |
| 15D83576D03 | | HOUSING, control head |
| 13D857971 | | ESCUTCHEON, cont. hd. (1-freq.) |
| 13D857972 | | ESCUTCHEON, cont. hd. (2-freq.) |

PARTS LIST 1 & 2 FREQUENCY MODELS CONTROL HEAD

TCN6026BE (Trunk-Mount, 1-Freq.) Dual Purpose
TCN6026BF (Trunk-Mount, 2-Freq.) Dual Purpose PL-1231-C

| | | |
|----------------------|-------------------|---|
| CR501 | 48-83461E45 | SEMICONDUCTOR DEVICE, diode; (SEE NOTE I) dual Zener type; 25 V |
| DS501 | 65-4151 | LAMP, incandescent; 6-8 V; .2 A; 1 cont; type No. 51 |
| DS502 | 65-4151 | 6-8 V; .2 A; 1 cont; type No. 51 |
| J501 | 9-830418 | CONNECTOR, receptacle; female; 4 cont. |
| R501 | 17-82350A04 | RESISTOR, fixed; unl. stated |
| R502 | 17-82350A04 | 33 $\pm 10\%$; 2 W |
| R503 | 18-857840 | 33 $\pm 10\%$; 2 W |
| R504 | 6-5581 | var; 25k $\pm 30\%$; .33 W |
| R505 | 6-6320 | 3.3k $\pm 10\%$; 1/2 W |
| R506 | 18-868896 | 10k $\pm 10\%$; 1/2 W |
| or18-857698 | | var; 25k $\pm 30\%$; .33 W; incl dpst switch; 1-freq. |
| 6-6336 | | var; 25k $\pm 30\%$; .33 W; 2 freq. 270 $\pm 10\%$; 1 W |
| S501 | or40-80247 | SWITCH, toggle; p/o R506; 1-freq. |
| S502 | 40-80246 | dpst ("on-off"); 2 freq. dpdt ("F1-F2"); 2 freq. |
| TB501 | 31-83826D02 | BOARD, term; 35 female; cont term. |
| XDS501, XDS502 | 9-863168 9-863168 | LAMPHOLDER; min; bayonet type |
| NON-REFERENCED ITEMS | | |
| 61-865158 | | LENS, indicator light; RED |
| 61-865159 | | LENS, indicator light; GRN |
| 3-82670A01 | | SCREW, control head |
| 36-858652 | | KNOB, control; 2 req'd |
| 2-482070 | | NUT, ring; knurled |

NOTE:

Replacement diodes must be ordered by Motorola part number only for optimum performance.

| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|------------------|-------------------|-------------|
|------------------|-------------------|-------------|

PARTS LIST 4 FREQUENCY MODELS CONTROL HEAD

TCN6026BJ Control Head, Trunk Mount PL-1232-C
(Dual Purpose)

| | | |
|----------------------|-------------|---|
| CR501 | 48-83461E45 | SEMICONDUCTOR DEVICE, diode; (SEE NOTE I) dual Zener type; 25 V |
| DS501 | 65-4151 | LAMP, incandescent; 6-8 V; .2 A; 1 cont; type No. 51 |
| DS502 | 65-4151 | 6-8 V; .2 A; 1 cont; type No. 51 |
| J501 | 9-830418 | CONNECTOR, receptacle; female; 4 contact |
| R501 | 17-82350A04 | RESISTOR, fixed; $\pm 10\%$; unl. stated |
| R502 | 17-82350A04 | 33; 2 W |
| R503 | 18-857840 | 33; 2 W |
| R504 | 6-5581 | var, 25k $\pm 30\%$ |
| R505 | 6-6320 | 3.3k; 1/2 W |
| R506 | 18-868896 | 10k; 1/2 W |
| R507 | 6-6336 | var.; 25k $\pm 30\%$; 0.33 W; incl. S501 |
| S501 | 40-83624D01 | 270; 1 W |
| S502 | 40-83624D01 | SWITCH, rotary; unl. stated |
| TB501 | 31-83826D02 | dpst; p/o R506 |
| XDS501 | 9-863168 | 1 pole; 4 position |
| XDS502 | 9-863168 | BOARD, terminal |
| | | 35 female contacts |
| | | LAMPHOLDER; |
| | | single contact; bayonet base |
| | | single contact; bayonet base |
| NON-REFERENCED ITEMS | | |
| 61-865158 | | LENS, indicator light; GRN |
| 61-865159 | | LENS, indicator light; RED |
| 2-482070 | | NUT, knurled; 13/64"-27 x 1/8" |
| 3-82670A01 | | SCREW, machine; 6-32 x 1.44" (2 req'd) |
| 36-858652 | | KNOB, vol. control (2 req'd) |
| 36-82869D01 | | KNOB, freq. selector |

NOTE:

- Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.
- When ordering crystal units, specify carrier frequency, crystal frequency and crystal type number.

| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|------------------|-------------------|-------------|
|------------------|-------------------|-------------|

PARTS LIST

IMPORTANT
USE ONLY THE FOLLOWING MOTOROLA PART NUMBERS WHEN ORDERING REPLACEMENT PARTS
MICROPHONE

TMN6013A Microphone PL-924-C
TMN6018A Microphone Weatherproof

| | | |
|----------------------|--|---|
| DP551 | 59-82933C01 or 59-82933C02 | CARTRIDGE, microphone; transistor amplifier |
| P551 | 28-16370 | CONNECTOR, plug; male; 4 contact |
| S551 | 40-82263G02 (TMN6013A) or 40-82263G01 (TMN6018A) | SWITCH, push; dpst not replaceable; in TMN6018A; P/O W601 |
| W551 | 1-80707A58 (TMN6013A) or 1-80724A28 (TMN6018A) | CORD, microphone; assembly; includes P551 and the following items: 41-852707 SPRING, strain relief 29-847034 LUG, insulation-piercing; 4 required |
| | | CORD, PLUG & SWITCH ASSY. includes P551, S551 |
| NON-REFERENCED ITEMS | | |
| 1-80720A94 | | CASE, microphone; includes hang-up stud |
| 11-2506 | | TUBING; No. 9 BLK, 5" length required |
| 3-124693 | | LOCKSCREW; 6-32 x 1/4" Phillips round head; 2 required |
| 42-852710 | | STRAP, strain relief |
| 38-852699 | | PUSHBUTTON |
| 15-82701B01 | | COVER, microphone case (front) |
| 32-82703B01 | | GASKET; neoprene |
| 4-114201 | | WASHER; 1/4" x 0.156" x .015 3 required |
| 3-127924 | | LOCKSCREW; 6-32 x 5/16" Phillips round head |
| 3-132436 | | SCREW, machine; 6-32 x 13/16" Phillips round head 3 required |
| 42-82702B01 | | RETAINER, mic, cartridge |
| 1-865398 | | MOUNTING KIT, microphone includes 64-85596 PLATE, mic, hang-up; 3-122830 SCREW, tapping; No. 8 x 1/2" slotted binder head; 2 required |

| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|------------------|-------------------|-------------|
|------------------|-------------------|-------------|

PARTS LIST CABLE KIT

TKN6055A Cable Kit (1-Freq., 12 V)
TKN6056A Cable Kit (2- & Multi-freq., 12 V) EPD-9982-K

| | | |
|-------|------------------------|---|
| F401 | 65-61682 | FUSE, cartridge; 25 amp; 32 v |
| F402 | 65-475247 | 6-1/4 amp; 32 v |
| F403 | 65-86099 | 7.5 amp; 32 v |
| P402 | 1-80715A24 | CONNECTOR, plug; incl: 9-801050 CONNECTOR, plug; 19-cont; female |
| | | 15-82075D03 HOUSING L.H. |
| | | 15-82075D01 HOUSING R.H. |
| | | 3-131758 SCREW, 4-40 x 1-1/8" |
| | | 2 req'd 2-129924 NUT, hex; 4-40 x 1/4"; 2 req'd; |
| | | 1-80717A73 SCREW & KNOB ASSY. 4-11722 WASHER, "C" |
| | | 4-800671 WASHER; .016" thick |
| | | 4-82113D01 WASHER; .032" thick; 42-864148 CLAMP, cable |
| | | 3-132127 SCREW, tapping; No. 6 x 3/4" plain hex head |
| W401 | 1-80744A37 | CABLE ASSY, special purpose incl: 30-858553 CABLE, power; 1 cond No. 12 ga; RED 22-1/2 ft. req'd 29-832116 LUG, for 3/8" stud; ref parts F401 and XF401 |
| W402 | 1-864643 | incl: 30-858552 CABLE, power; 1 cond; No. 12 ga; BLK; 5-1/2 ft. req'd 29-832116 LUG, for 3/8" stud |
| W403 | 1-80705A19 | incl. 29-824456 LUG, for No. 10 stud 37-82603D20 SLEEVE, coded No. 20 29-82602D01 CONNECTOR, plug; 1 cont; ref part XF402 |
| W404 | 1-80744A39 | incl: 29-865065 LUG, for 3/8" stud 37-82603D19 SLEEVE, coded No. 19 29-82602D01 CONNECTOR, plug; 1 cont; ref part XF403 |
| W405 | 30-858513 or 30-864650 | CABLE, special purpose; 13 cond 17 ft req'd 1-freq 17 cond 17 ft req'd 2- & multi-freq. |
| XF401 | | FUSEHOLDER; incl: 14-82882A01 BODY 14-82883A01 CAP; 42-82884A01 CLIP, fuse; 2 req'd; |
| XF402 | 1-80705A07 | 41-82885A01 SPRING incl: 14-82882A01 BODY 14-82883A01 CAP 41-82885A01 SPRING 1-80705A08 FUSE CLIP AND LEAD ASSY; incl: 42-82884A01 CLIP, fuse 10-343 LEAD, elect; 1 cond No. 18 ga; ORG; 57" req'd 1-80705A09 FUSE CLIP AND LEAD ASSY; incl. 42-82884A01 CLIP, fuse 30S10310A62 LEAD, elect 1 cond No. 18 ga; ORG; 9" req'd ref part F402 |
| XF403 | 1-80744A38 | incl: 14-82882A01 BODY 14-82883A01 CAP 41-82885A01 SPRING 1-80705A11 FUSE CLIP AND LEAD ASSY; incl: 42-82884A01 CLIP, fuse 10-345 LEAD, elect; 1 cond; No. 18 ga; GRN; 97" req'd 1-80705A12 FUSE CLIP AND LEAD ASSY; incl: 42-82884A01 CLIP, fuse 30S10310A62 LEAD, elect; 1 cond; No. 18 ga; GRN; 9" req'd ref part F403 |

| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|------------------|-------------------|-------------|
|------------------|-------------------|-------------|

| | | |
|----------------------|--|--|
| NON-REFERENCED ITEMS | | |
| 29-82602D01 | | CONNECTOR, plug; male; single cont; 19 req'd |
| 37-82603D01 | | SLEEVE, coded; |
| 37-82603D02 | | 1 |
| 37-82603D03 | | 2 |
| 37-82603D04 | | 3 |
| 37-82603D05 | | 4 |
| 37-82603D06 | | 5 |
| 37-82603D07 | | 6 |
| 37-82603D08 | | 7 |
| 37-82603D09 | | 8 |
| 37-82603D10 | | 9 |
| 37-82603D11 | | 10 |
| 37-82603D12 | | 11 |
| 37-82603D13 | | 12 |
| 37-82603D14 | | 13 |
| 37-82603D15 | | 14 |
| 37-82603D16 | | 15 |
| 37-82603D17 | | 16 |
| 37-82603D18 | | 17 |
| 37-82603D21 | | 18 |
| | | 21 |

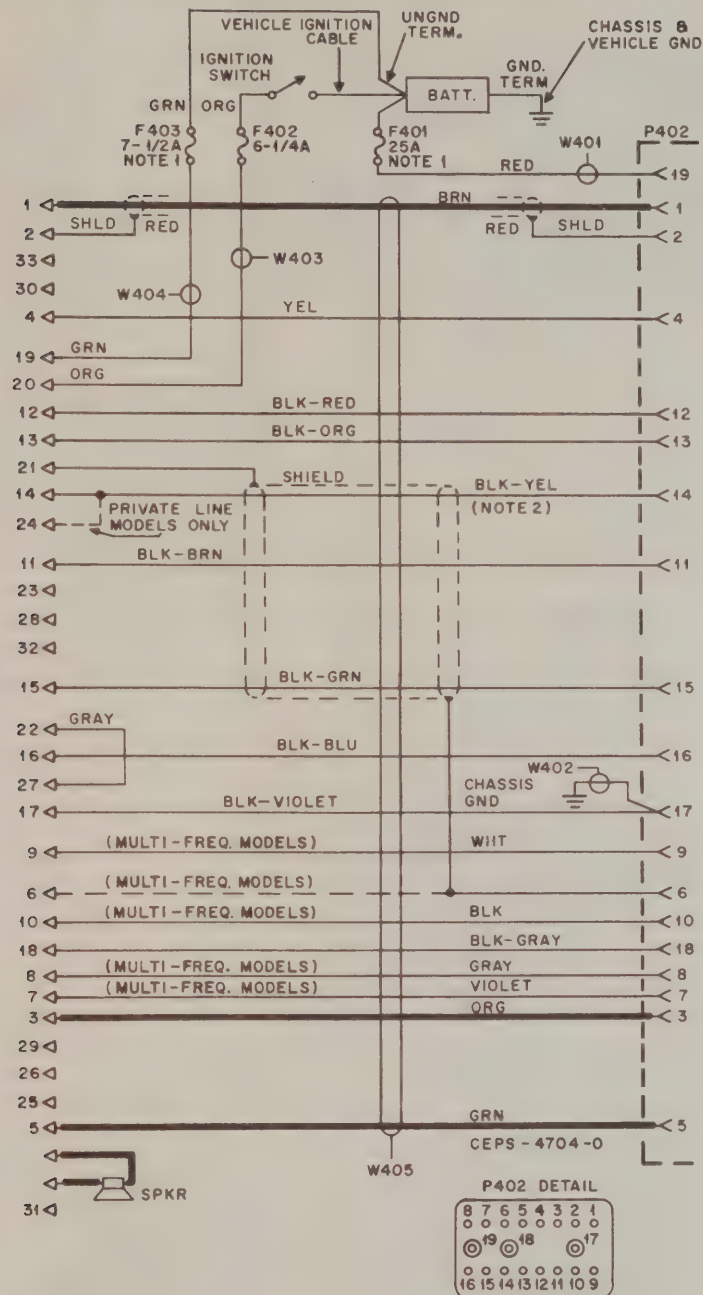
NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

TCN6098CJ Control Head Trunk Mount 4-Frequency PL-1237-A
Dual Purpose with Dimmer

| | | |
|----------------------|-------------|---|
| CR505 | 48-83461E45 | SEMICONDUCTOR DEVICE, diode; (SEE NOTE) dual Zener type; 25 V |
| DS501, 502 | 65S4151 | LAMP, incandescent; min. bay; 6-8 V; 0.2 A; type No. 51 |
| J501 | 9K830418 | CONNECTOR, receptacle; female; 4 contact; does not incl 457699 LOCKWASHER; 13/16" internal; 2A482070 NUT, machine; ring (knurled) |
| R503 | 18K857840 | RESISTOR, fixed; $\pm 10\%$; 1/4 W; unl. stated |
| R504 | 6R5581 | var; 25k $\pm 30\%$; 0.33 W |
| R505 | 6R6320 | 3.3k; 1/2 W |
| R506 | 18K868896 | 10k; 1/2 W |
| R507 | 6S6336 | var; 25k $\pm 30\%$; 0.33 W; incl S501 |
| R512 | 17D82117B05 | 270; 1 W |
| S501 | 40C83624D01 | 50; 5 W |
| S502 | 40C83624D01 | SWITCH, rotary |
| TB501 | 31C83826D01 | dpst (p/o R506) |
| XDS501, 502 | 9B863168 | 1 pole; 4 position |
| | | TERMINAL BOARD; |
| | | 35 female contact terminals |
| | | LAMPHOLDER |
| | | min. bay. |
| NON-REFERENCED ITEMS | | |
| 61B83678D01 | | LENS, indicator light; RED |
| 61B83678D02 | | LENS, indicator light; GRN |
| 3A82670A01 | | SCREW, machine; special type (2 req'd) |
| 36K858652 | | KNOB control (2 req'd) (VOL.SQ) |
| 36B82869D01 | | KNOB, control (F1-F4) |
| 15C82401D01 | | COVER, housing |
| 15D83576D03 | | HOUSING, control head |
| 13D82286C23 | | ESCUTCHEON, cont. hd. |

TRUNK-MOUNT CABLING



NOTES:

1. DO NOT USE SLOW-BLOW FUSE.
2. PIN NO. 14 IS CONNECTED TO TB501-14 IN CARRIER SQUELCH MODELS AND TO TB501-24 IN "PRIVATE-LINE" MODELS.

EPS-4846-O

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

Trunk Mount Cabling
Schematic Diagram
Motorola No. 63P81011E58-A
8/20/75-PO

| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|------------------|-------------------|-------------|
|------------------|-------------------|-------------|

PARTS LIST CABLE KIT

TKN6055A Cable Kit (1-Freq., 12 V)
TKN6056A Cable Kit (2- & Multi-freq., 12 V) EPD-9982-L

| | | |
|-------|---------------------------|---|
| F401 | 65-61682 | <u>FUSE, cartridge:</u> 25 amp; 32 v |
| F402 | 65-475247 | 6-1/4 amp; 32 v |
| F403 | 65-86099 | 7.5 amp; 32 v |
| J402 | 1-80715A24 | <u>CONNECTOR, plug:</u> incl: 9-801050 CONNECTOR, plug: 19-cont; female 15-82075D03 HOUSING L.H. 15-82075D01 HOUSING R.H. 3-131758 SCREW, 4-40 x 1-1/8" 2 req'd 2-129924 NUT, hex: 4-40 x 1/4"; 2 req'd; 1-80717A73 SCREW & KNOB ASSY. 4-11722 WASHER, "C" 4-800671 WASHER: .016" thick 4-82113D01 WASHER: .032" thick; 42-864148 CLAMP, cable 3-132127 SCREW, tapping: No. 6 x 3/4" plain hex head |
| W401 | 1-80744A37 | <u>CABLE ASSY, special purpose</u> incl: 30-858553 CABLE, power; 1 cond No. 12 ga; RED 22-1/2 ft. req'd 29-832116 LUG, for 3/8" stud; ref parts F401 and XF401 |
| W402 | 1-864643 | incl: 30-858552 CABLE, power: 1 cond; No. 12 ga; BLK; 5-1/2 ft. req'd 29-832116 LUG, for 3/8" stud |
| W403 | 1-80705A19 | incl. 29-824456 LUG, for No. 10 stud 37-82603D20 SLEEVE, coded No. 20 29-82602D01 CONNECTOR, plug: 1 cont; ref part XF402 |
| W404 | 1-80744A39 | incl: 29-865065 LUG, for 3/8" stud 37-82603D19 SLEEVE, coded No. 19 29-82602D01 CONNECTOR, plug: 1 cont; ref part XF403 |
| W405 | 30-858513 or 30-864650 | <u>CABLE, special purpose:</u> 13 cond 17 ft req'd 1-freq 17 cond 17 ft req'd 2- & multi-freq. |
| XF401 | | <u>FUSEHOLDER:</u> incl-14-82882A01 BODY 14-82883A01 CAP; 42-82884A01 CLIP, fuse: 2 req'd; 41-82885A01 SPRING |
| XF402 | 1-80705A07 | incl: 14-82882A01 BODY 14-82883A01 CAP 41-82885A01 SPRING 1-80705A08 FUSE CLIP AND LEAD ASSY: incl: 42-82884A01 CLIP, fuse 10-343 LEAD, elect: 1 cond No. 18 ga; ORG; 57" req'd 1-80705A09 FUSE CLIP AND LEAD ASSY: incl. 42-82884A01 CLIP, fuse 30S10310A62 LEAD, elect 1 cond No. 18 ga; ORG; 9" req'd ref part F402 |
| XF403 | 1-80744A38 | incl: 14-82882A01 BODY 14-82883A01 CAP 41-82885A01 SPRING 1-80705A11 FUSE CLIP AND LEAD ASSY: incl: 42-82884A01 CLIP, fuse 10-345 LEAD, elect; 1 cond; No. 18 ga; GRN; 97" req'd 1-80705A12 FUSE CLIP AND LEAD ASSY: incl: 42-82884A01 CLIP, fuse 30S10310A62 LEAD elect; 1 cond; No. 18 ga; GRN; 9" req'd ref part F403 |

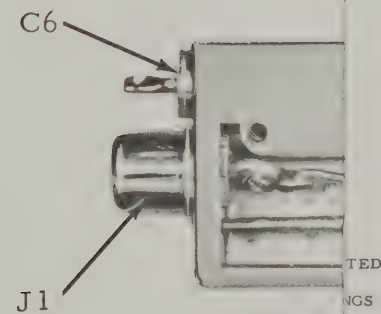
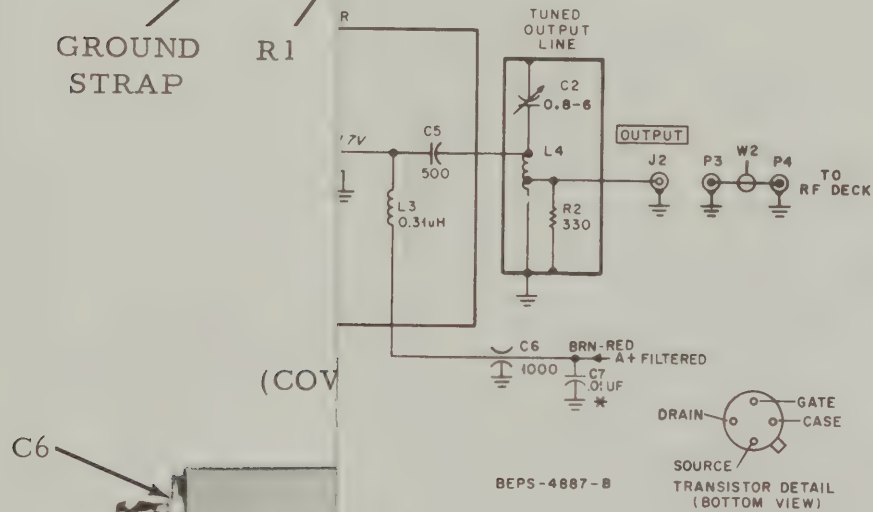
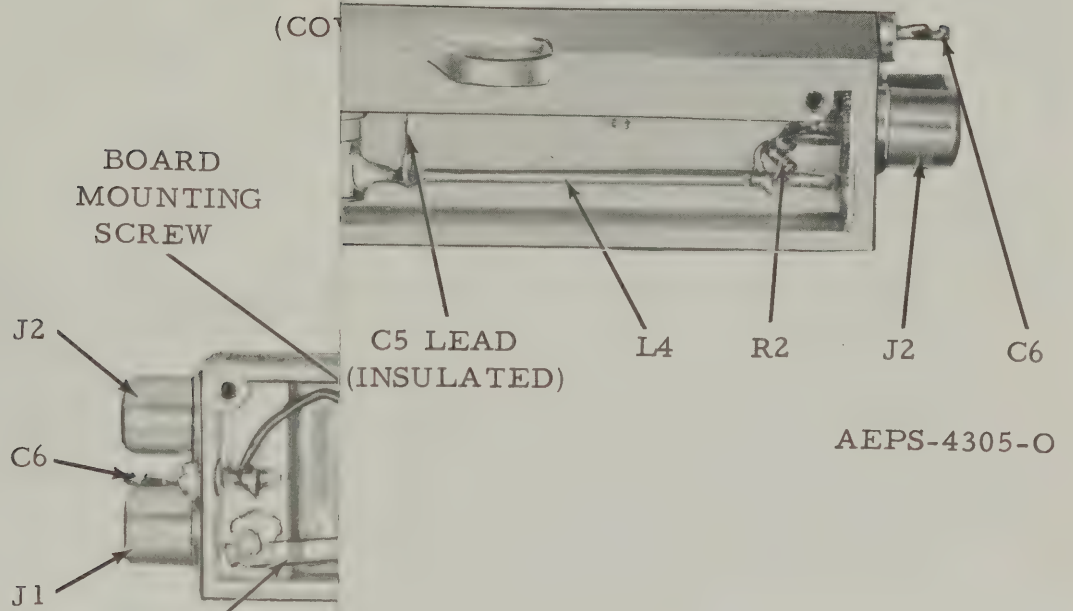
| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|------------------|-------------------|-------------|
|------------------|-------------------|-------------|

| NON-REFERENCED ITEMS | | |
|----------------------|-------------|---|
| | 29-82602D01 | CONNECTOR, plug: male; single cont; 19 req'd |
| | | <u>SLEEVE, coded:</u> |
| | 37-82603D01 | 1 |
| | 37-82603D02 | 2 |
| | 37-82603D03 | 3 |
| | 37-82603D04 | 4 |
| | 37-82603D05 | 5 |
| | 37-82603D06 | 6 |
| | 37-82603D07 | 7 |
| | 37-82603D08 | 8 |
| | 37-82603D09 | 9 |
| | 37-82603D10 | 10 |
| | 37-82603D11 | 11 |
| | 37-82603D12 | 12 |
| | 37-82603D13 | 13 |
| | 37-82603D14 | 14 |
| | 37-82603D15 | 15 |
| | 37-82603D16 | 16 |
| | 37-82603D17 | 17 |
| | 37-82603D18 | 18 |
| | 37-82603D21 | 21 |

NOTE:

Replacement diodes and transistors must be ordered by
Motorola part number only for optimum performance.

OUTPUT SIDE
(COVER PLATE REMOVED)



PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

RF Preamplifier
Schematic Diagram
Motorola No. 63P81011E47-D
8/20/75-PO

OPTION
AMPLIFIER
KIT
AMPLIFIER
KIT
-3050-A

| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|---------------------|----------------------|-------------|
|---------------------|----------------------|-------------|

PARTS LIST CABLE KIT

TKN6055A Cable Kit (1-Freq., 12 V)
TKN6056A Cable Kit (2- & Multi-freq., 12 V) EPD-9982-L

| | | |
|-------|---------------------------|---|
| F401 | 65-61682 | <u>FUSE, cartridge:</u> 25 amp; 32 v |
| F402 | 65-475247 | 6-1/4 amp; 32 v |
| F403 | 65-86099 | 7.5 amp; 32 v |
| J402 | 1-80715A24 | <u>CONNECTOR, plug:</u> incl: 9-801050 CONNECTOR, plug: 19-cont; female 15-82075D03 HOUSING L.H. 15-82075D01 HOUSING R.H. 3-131758 SCREW, 4-40 x 1-1/8" 2 req'd 2-129924 NUT, hex: 4-40 x 1/4"; 2 req'd; 1-80717A73 SCREW & KNOB ASSY. 4-11722 WASHER, "C" 4-800671 WASHER: .016" thick 4-82113D01 WASHER: .032" thick; 42-864148 CLAMP, cable 3-132127 SCREW, tapping; No. 6 x 3/4" plain hex head |
| W401 | 1-80744A37 | <u>CABLE ASSY, special purpose</u> incl: 30-858553 CABLE, power; 1 cond No. 12 ga; RED 22-1/2 ft. req'd 29-832116 LUG, for 3/8" stud; ref parts F401 and XF401 |
| W402 | 1-864643 | incl: 30-858552 CABLE, power; 1 cond; No. 12 ga; BLK; 5-1/2 ft. req'd 29-832116 LUG, for 3/8" stud |
| W403 | 1-80705A19 | incl. 29-824456 LUG, for No. 10 stud 37-82603D20 SLEEVE, coded No. 20 29-82602D01 CONNECTOR, plug: 1 cont; ref part XF402 |
| W404 | 1-80744A39 | incl; 29-865065 LUG, for 3/8" stud 37-82603D19 SLEEVE, coded No. 19 29-82602D01 CONNECTOR, plug: 1 cont; ref part XF403 |
| W405 | 30-858513 or 30-864650 | <u>CABLE, special purpose:</u> 13 cond 17 ft req'd 1-freq 17 cond 17 ft req'd 2- & multi-freq. |
| XF401 | | <u>FUSEHOLDER:</u> incl: 14-82882A01 BODY 14-82883A01 CAP; 42-82884A01 CLIP, fuse: 2 req'd; 41-82885A01 SPRING |
| XF402 | 1-80705A07 | incl: 14-82882A01 BODY 14-82883A01 CAP 41-82885A01 SPRING 1-80705A08 FUSE CLIP AND LEAD ASSY: incl: 42-82884A01 CLIP, fuse 10-343 LEAD, elect: 1 cond No. 18 ga; ORG; 57" req'd 1-80705A09 FUSE CLIP AND LEAD ASSY: incl. 42-82884A01 CLIP, fuse 30S10310A62 LEAD, elect 1 cond No. 18 ga; ORG; 9" req'd ref part F402 |
| XF403 | 1-80744A38 | incl: 14-82882A01 BODY 14-82883A01 CAP 41-82885A01 SPRING 1-80705A11 FUSE CLIP AND LEAD ASSY: incl: 42-82884A01 CLIP, fuse 10-345 LEAD, elect; 1 cond; No. 18 ga; GRN; 97" req'd 1-80705A12 FUSE CLIP AND LEAD ASSY: incl: 42-82884A01 CLIP, fuse 30S10310A62 LEAD elect; 1 cond; No. 18 ga; GRN; 9" req'd ref part F403 |

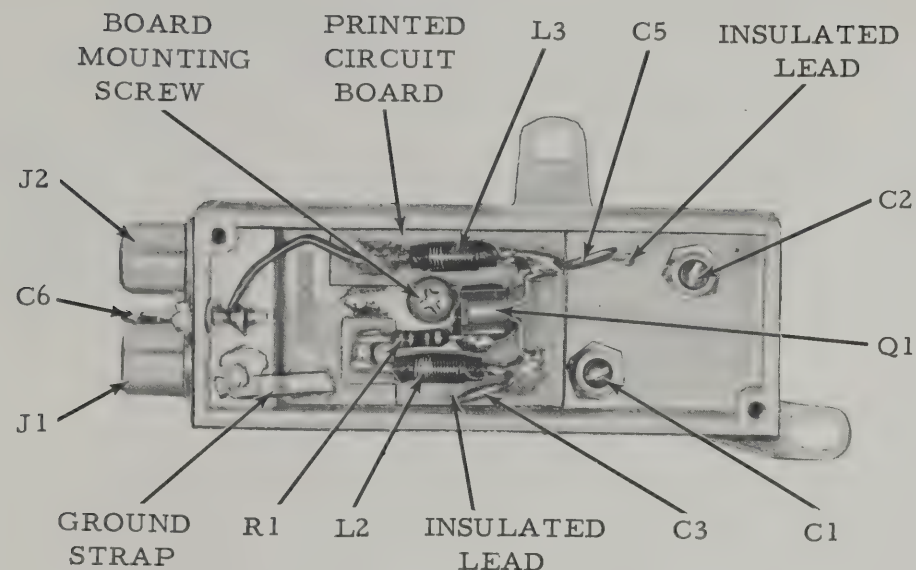
| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|---------------------|----------------------|-------------|
|---------------------|----------------------|-------------|

| NON-REFERENCED ITEMS | | |
|----------------------|-------------|---|
| | 29-82602D01 | CONNECTOR, plug: male; single cont; 19 req'd |
| | | <u>SLEEVE, coded:</u> |
| | 37-82603D01 | 1 |
| | 37-82603D02 | 2 |
| | 37-82603D03 | 3 |
| | 37-82603D04 | 4 |
| | 37-82603D05 | 5 |
| | 37-82603D06 | 6 |
| | 37-82603D07 | 7 |
| | 37-82603D08 | 8 |
| | 37-82603D09 | 9 |
| | 37-82603D10 | 10 |
| | 37-82603D11 | 11 |
| | 37-82603D12 | 12 |
| | 37-82603D13 | 13 |
| | 37-82603D14 | 14 |
| | 37-82603D15 | 15 |
| | 37-82603D16 | 16 |
| | 37-82603D17 | 17 |
| | 37-82603D18 | 18 |
| | 37-82603D21 | 21 |

NOTE:

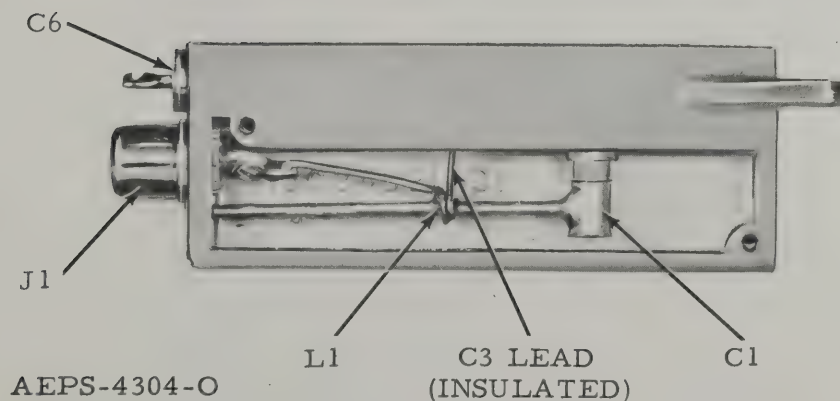
Replacement diodes and transistors must be ordered by
Motorola part number only for optimum performance.

TOP VIEW
(COVER PLATE REMOVED)



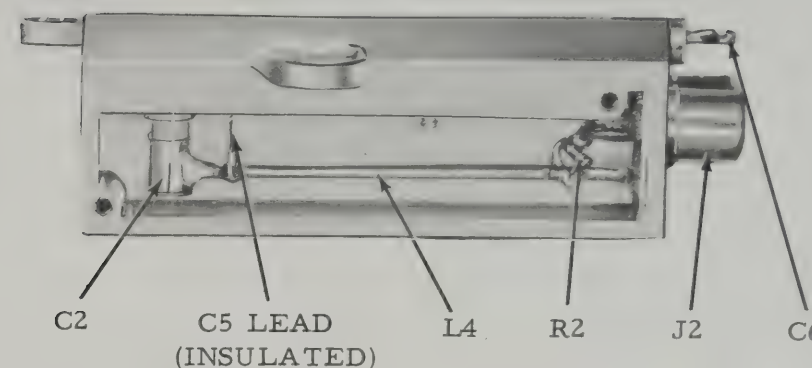
AEPS-4303-O

INPUT SIDE
(COVER PLATE REMOVED)

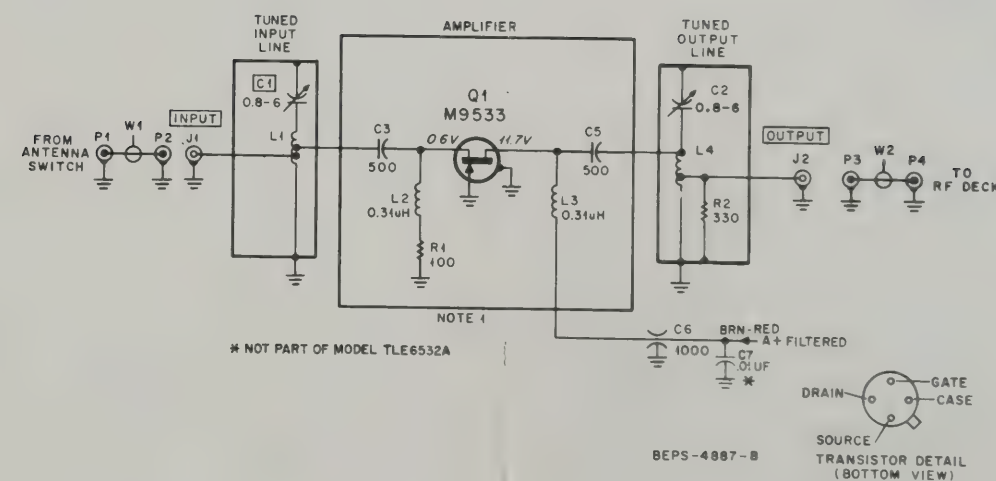


AEPS-4304-O

OUTPUT SIDE
(COVER PLATE REMOVED)



AEPS-4305-O



NOTES:

1. ALL COMPONENTS WITHIN THIS BOX ARE PHYSICALLY MOUNTED ON PRINTED CIRCUIT BOARD.
2. REFERENCES OUTLINED BY A RECTANGLE INDICATE MARKINGS ON CHASSIS.
3. ALL CAPACITOR VALUES ARE IN pF UNLESS OTHERWISE STATED.
4. ALL VOLTAGE READINGS MEASURED WITH A 20,000 OHM-PER-VOLT MULTIMETER.

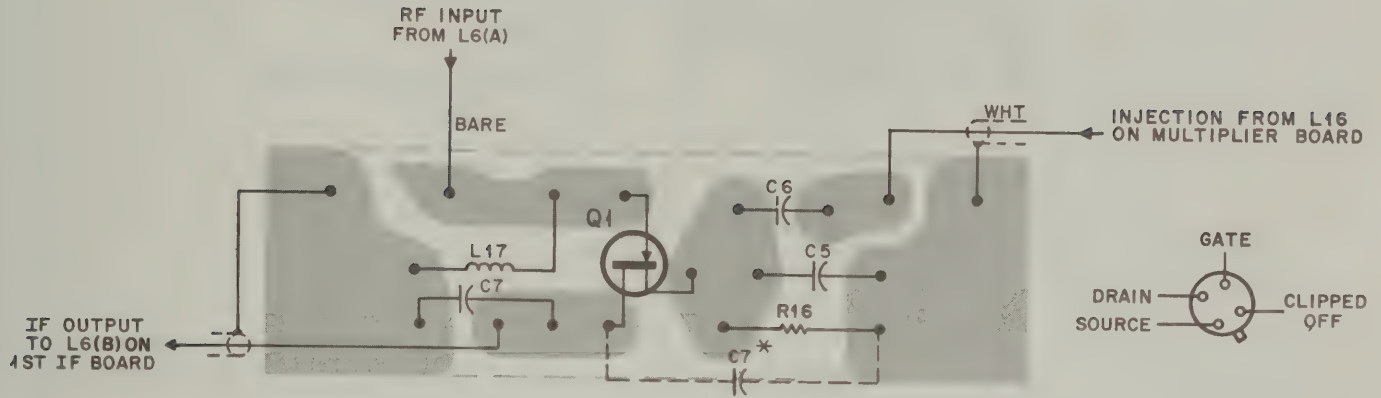
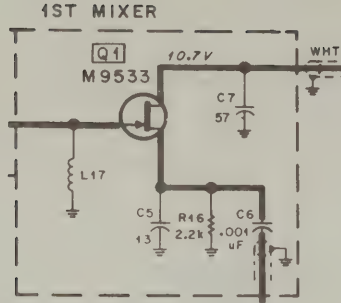
MODEL TABLE

| MODEL | SUFFIX | SUB-MODEL | SUFFIX | DESCRIPTION |
|-------------------|--------|-----------|--------|--------------|
| TLE1280A (MOBILE) | | TLE6532A | 1 | PREAMPLIFIER |
| TLE1290A (BASE) | | TLN4182A | | CABLE KIT |
| | | TLE6532A | 1 | PREAMPLIFIER |
| | | TLN4372A | | CABLE KIT |

EPS-3050-A

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

RF Preamplifier
Schematic Diagram
Motorola No. 63P81011E47-D
8/20/75-PO



* EARLIER MODELS ONLY

BD-BEPS-4823-0
OL-BEPS-4824-B

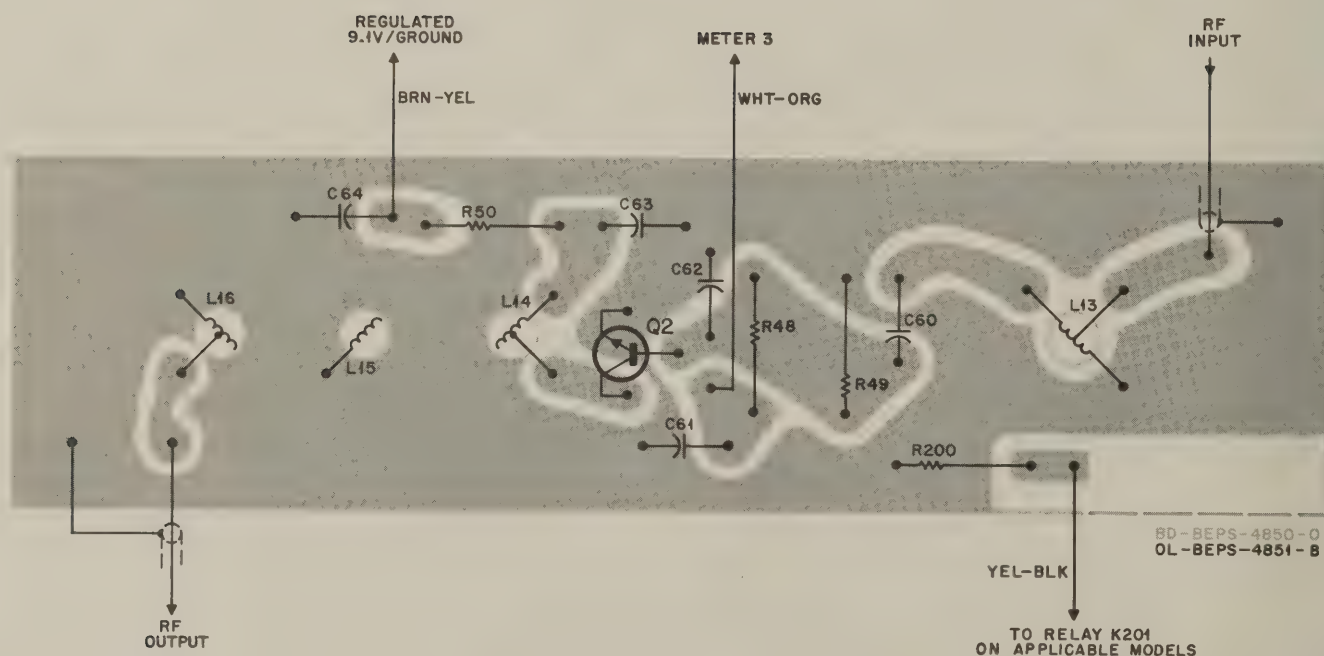
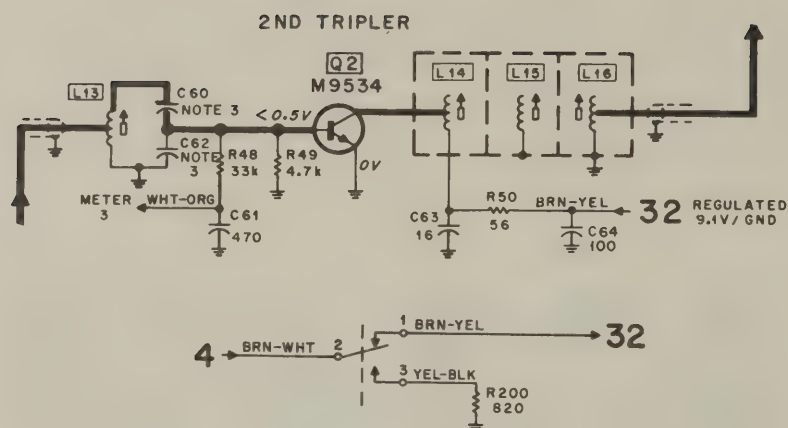
REVISIONS

PEPS-4841-B

| BOARD AND SUFFIX NO. | REF. SYMBOL | CHANGE | LOCATION |
|----------------------|-------------|---|----------|
| TLE6583A | C7 | WAS 22 pF $\pm 5\%$; NP0 AND CONNECTED AS SHOWN. | |

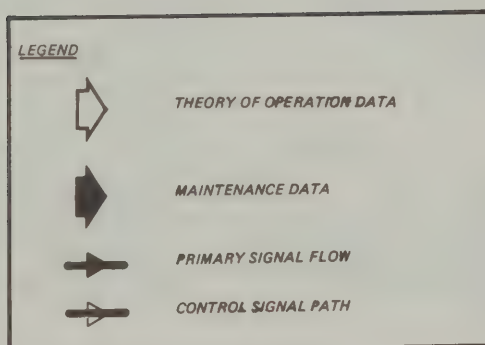
PARTS LIST & NOTES SHOWN ON
TRANSMITTER-RECEIVER
SCHEMATIC & INTERCABLING DIAGRAM

Model TLE6583A RF Deck
Circuit Board Detail
Motorola No. PEPS-4841-B
8/20/75-PO



PARTS LIST & NOTES SHOWN ON
TRANSMITTER-RECEIVER
SCHEMATIC & INTERCABLING DIAGRAM

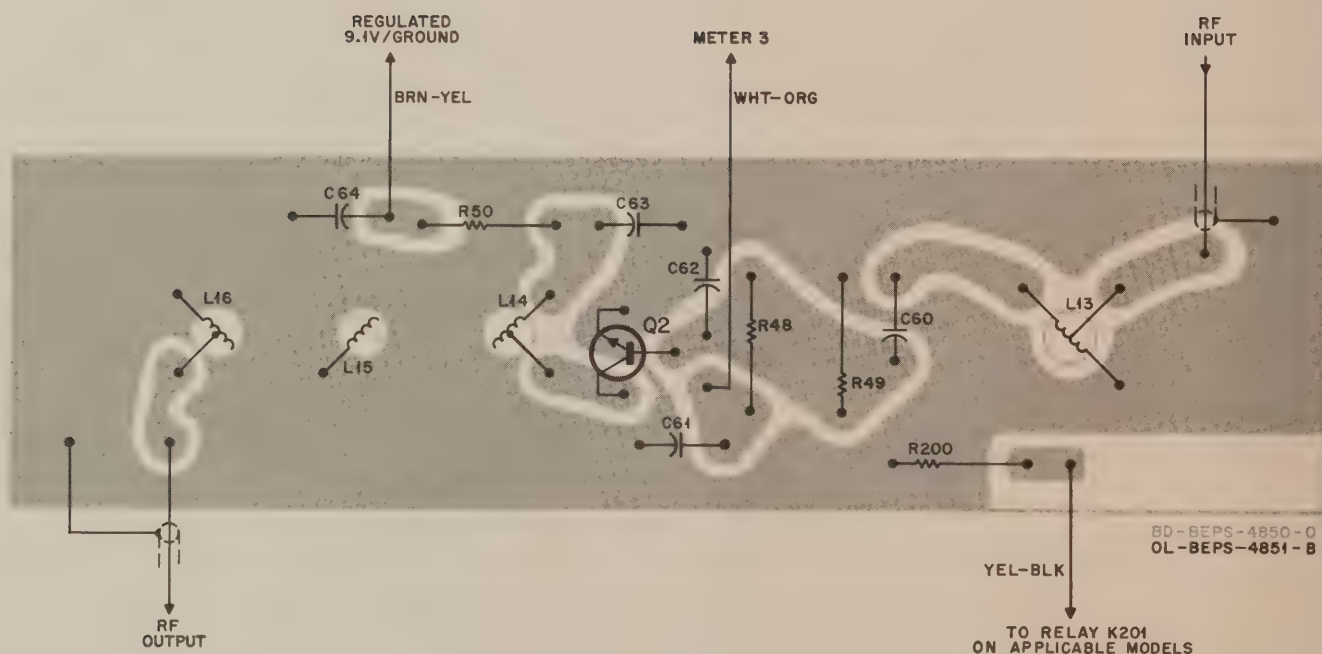
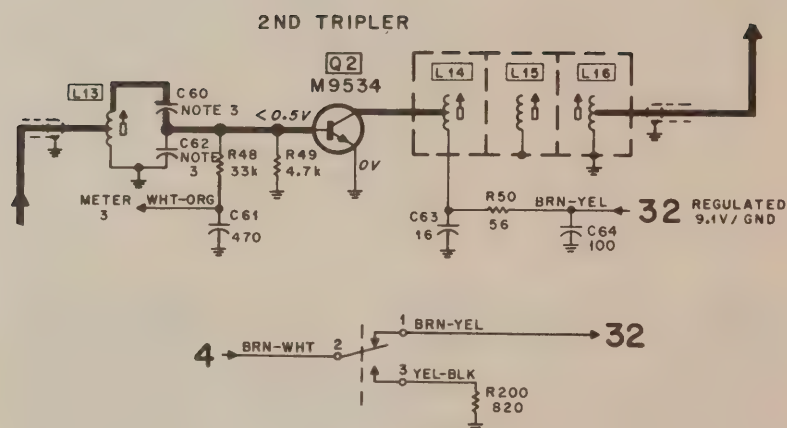
TLE6600A Series Injection Tripler
Circuit Board Detail
Motorola No. PEPS-4852-B
8/20/75-PO



FUNCTION -

Used as a code generator and decoder in "Consolette" Base Stations and "Mocom-70" Mobiles. Generates and decodes 23-bit binary code word in Digital "Private-Line" Squelch Systems.

Models TLN5817A/TLN5817AV "Digital Private-Line"
 Squelch Encoder-Decoder Schematic Diagram
 Motorola No. 68P81025E69-B
 8/20/75-PO



PARTS LIST & NOTES SHOWN ON
TRANSMITTER-RECEIVER
SCHEMATIC & INTERCABLING DIAGRAM

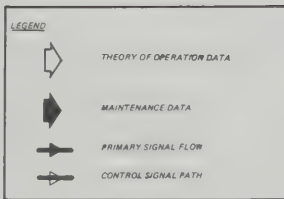
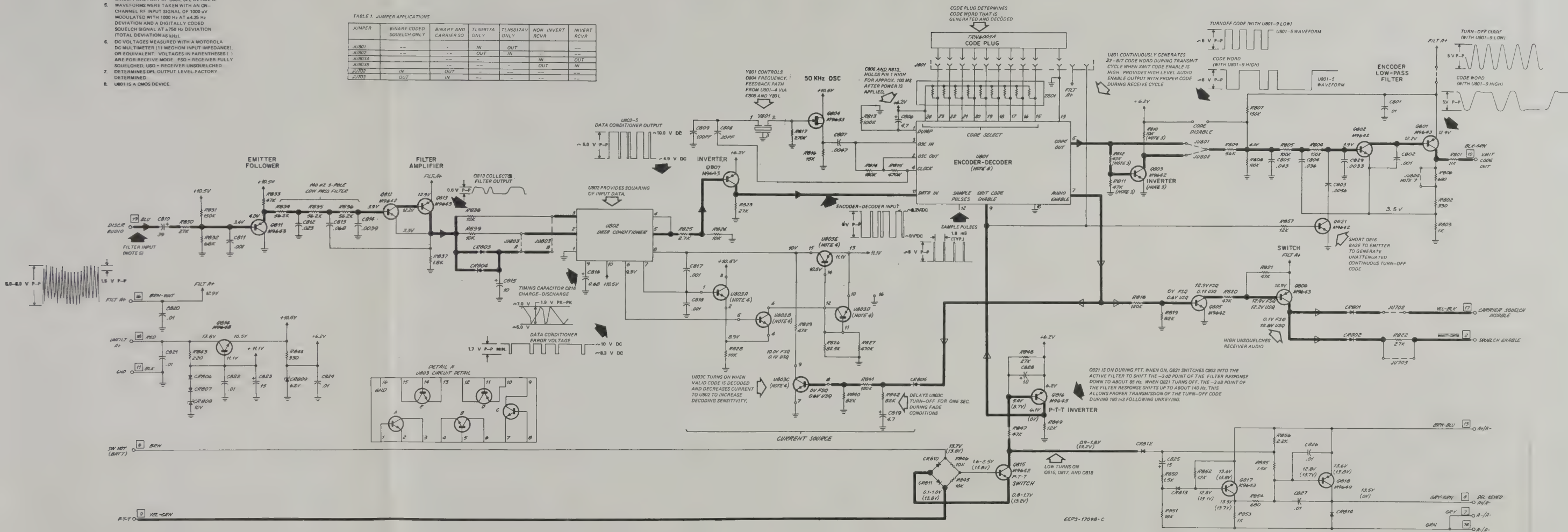
TLE6600A Series Injection Tripler
Circuit Board Detail
Motorola No. PEPS-4852-B
8/20/75-PO

NOTES

1. UNLESS OTHERWISE INDICATED
RESISTOR VALUES ARE IN OHMS
CAPACITOR VALUES ARE IN MICROFARADS.
2. SEE TABLE 1 FOR JUMPER APPLICATIONS.
3. RB10, RB11, RB12, AND QB03 USED ON
TLN5817AV ONLY.
4. TRANSISTORS IN CURRENT SOURCE
CIRCUIT ARE PART OF UB03. SEE DETAIL A.
5. WAVEFORMS WERE TAKEN WITH AN ON-
CHANNEL RF INPUT SIGNAL OF 1000 uV
MODULATED WITH 1000 Hz AT ±4.25 Hz
DEVIATION AND A DIGITALLY CODED
SQUELCH SIGNAL AT 4750 Hz DEVIATION
(TOTAL DEVIATION ±8 kHz).
6. DC VOLTAGES MEASURED WITH A MOTOROLA
DC MULTIMETER (11 MEGOHM INPUT IMPEDANCE),
OR EQUIVALENT. VOLTAGES IN PARENTHESES ()
ARE FOR RECEIVE MODE. P80 = RECEIVER FULLY
SQUELCHED; U80 = RECEIVER UNSQUELCHED.
7. DETERMINES OPL OUTPUT LEVEL FACTORY
DETERMINED.
8. UB01 IS A CMOS DEVICE.

TABLE 1. JUMPER APPLICATIONS

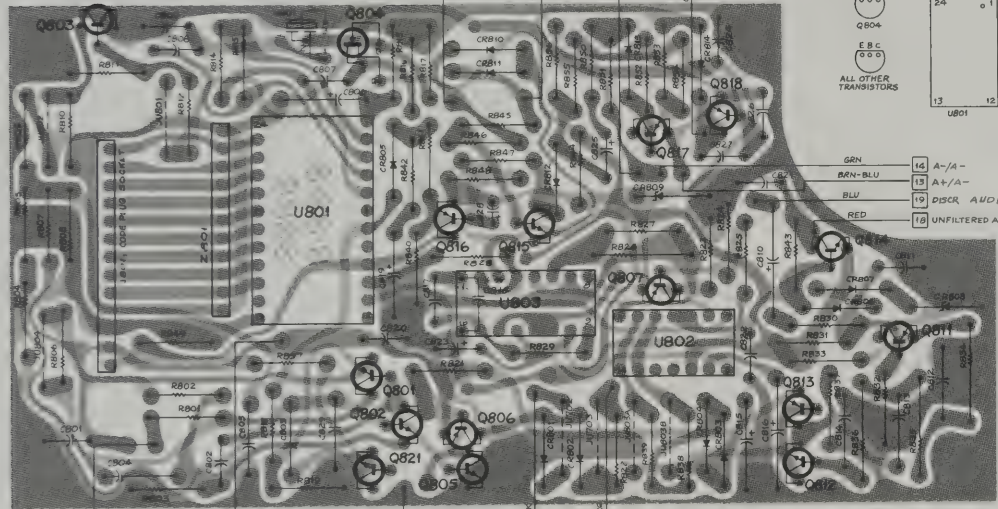
| JUMPER | BINARY CODED SQUELCH ONLY | BINARY AND CARRIER SQ | TLN5817A ONLY | TLN5817AV ONLY | NON-INVERT RCVR | INVERT RCVR |
|--------|------------------------------|--------------------------|------------------|-------------------|--------------------|----------------|
| JU801 | --- | --- | IN | OUT | --- | --- |
| JU802 | --- | --- | OUT | IN | --- | --- |
| JU803A | --- | --- | --- | --- | IN | OUT |
| JU803B | --- | --- | --- | --- | OUT | IN |
| JU804 | IN | OUT | --- | --- | --- | --- |
| JU805 | OUT | IN | --- | --- | --- | --- |



FUNCTION -

Used as a code generator and decoder in "Console" Base Stations and "Mocom-70" Mobiles. Generates and decodes 23-bit binary code word in Digital "Private-Line" Squelch Systems.

Models TLN5817A/TLN5817AV "Digital Private-Line" Squelch Encoder-Decoder Schematic Diagram
Motorola No. 68P81025E69-B
8/20/75-PO



PARTS LIST

TLN5817A/TLN5817AV Encoder-Decoder Board PL-3385-A

| | | |
|---|-------------|--|
| C801, 820, 821, 822, 824, 826, 827 | 21-82428B59 | CAPACITOR, fixed: $\mu F \pm 5\%$ 50 V unless otherwise stated .01 $\pm 80-20\%$; 200 V |
| C802, 811, 817 | 21-82187B20 | .001 $\pm 10\%$; 100 V |
| C803 | 8-83813H26 | .0056 |
| C804 | 8-83813H24 | .036 |
| C805 | 8-83213H14 | .043 |
| C806, 819 | 23-84762H07 | 10 $\pm 20\%$; 10 V |
| C807 | 21-82428B09 | .0047 $\pm 10\%$; 100 V |
| C808 | 21-840849 | 20 μF ; NP0 |
| C809 | 23-83798B01 | 100 μF ; 200 V |
| C810 | 8-83213H36 | 39 μF ; 10 V |
| C812 | 8-82950S13 | .023 |
| C813 | 8-83813H23 | .068 |
| C814 | 8-83813H19 | .0039 |
| C815 | 23-84762H03 | 10 $\pm 10\%$; 20 V |
| C816 | 23-82783B48 | 9.48 μF ; 10 V |
| C818 | 21-82187B14 | .001 $\pm 10\%$; 100 V |
| C823, 825 | 23-84538C04 | 15 $\pm 20\%$; 20 V |
| C828 | 23-84538C01 | 1 $\pm 20\%$; 35 V |
| C829 | 8-83813H27 | .0033 |
| C8R01, 802, 805, 806, 807, 812, 813 | 48-83654H01 | DIODE (SEE NOTE) silicon |
| C8R03, 804 | 48-84615A01 | hot carrier |
| C8R08 | 48-82256C11 | Zener type; 10 V |
| C8R09 | 48-83696D13 | Zener type; 6.2 V |
| C8R19, 811, 814 | 48-82466H13 | silicon |
| J801 | 9-82071K01 | SOCKET; female; 12 contact |
| Q801, 806, 807, 811, 813, 816, 817 | 48-869643 | TRANSISTOR (SEE NOTE) PNP; type M9643 |
| Q802, 805, 812, 815, 821 | 48-869642 | NPN; type M9642 |
| Q803 | 48-869648 | NPN; type M9642 (TLN5817AV only) |
| Q814 | 48-869648 | field-effect |
| Q818 | 48-869649 | NPN; type M9648 PNP; type M9649 |
| R801 | 6-12A4474 | RESISTOR, fixed: $\pm 5\%$; 1/4 W unless otherwise stated |
| R802, 844 | 6-12A437 | 11k |
| R803, 853 | 6-12A449 | 330 |
| R804, 805, 808, 813 | 6-12A497 | 100k |
| R805, 854 | 6-12A445 | 680 |
| R807, 831 | 6-12A802 | 150k |
| R809 | 6-12A491 | 56k |
| R810 | 6-12A473 | 10k (TLN5817AV only) |
| R811, 812 | 6-12A489 | 47k (TLN5817AV only) |
| R814 | 6-12A806 | 180k |
| R815, 817, 827 | 6-12A814 | 470k |
| R816 | 6-12A477 | 150k |
| R818, 841 | 6-12A499 | 120k $\pm 10\%$ |
| R819, 840, 842 | 6-12A495 | 82k $\pm 10\%$ |
| R820, 821 | 6-12A489 | 47k $\pm 10\%$ |
| R822 | 6-12A499 | 2.7k $\pm 10\%$ |
| R823, 830, 848 | 6-12A483 | 27k |
| R824, 829, 830, 839, 845, 846 | 6-12A473 | 10k |
| R825 | 6-12A459 | 2.7k |
| R826 | 6-10621D80 | 56.2k $\pm 1\%$; 1/8 W |
| R829, 833, 847 | 6-12A489 | 47k |
| R832 | 6-12A493 | 68k |
| R834, 835, 836 | 6-13755D64 | 56.2k $\pm 1\%$ |
| R837 | 6-12A455 | 1.8k |
| R843 | 6-12A413 | 12k |
| R849, 852, 859 | 6-12A475 | 12k $\pm 10\%$ |
| R850, 855 | 6-12A453 | 1.5k |
| R851 | 6-12A479 | 18k |

[illegible]

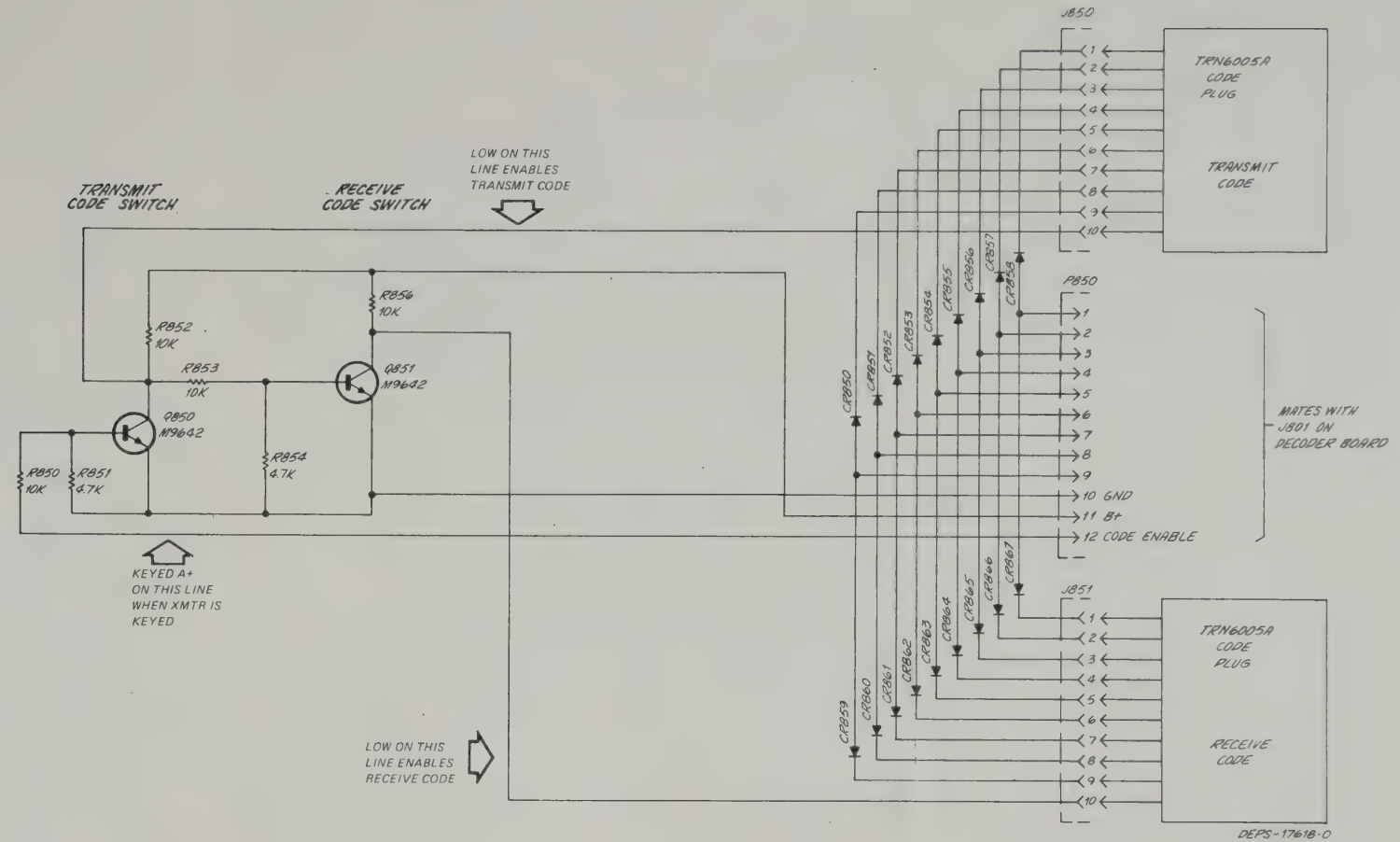
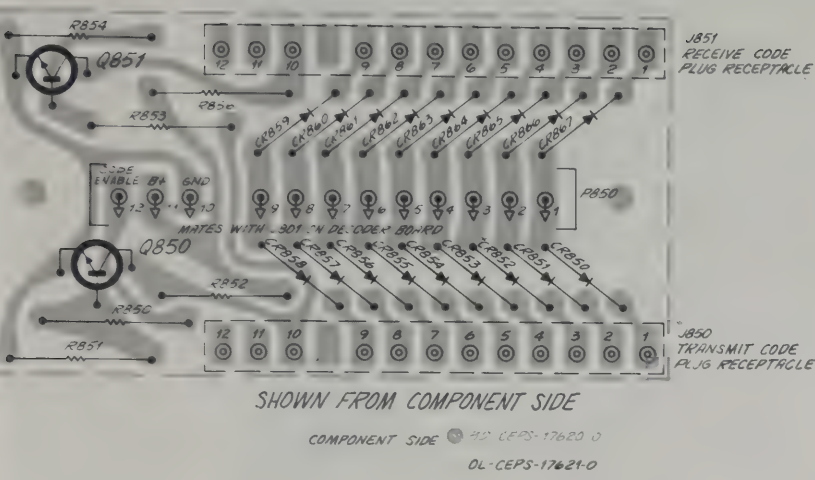
| | | |
|-----------------|-------------|------------------------------------|
| U801 | 51-84267A82 | type M6782 |
| U802 | 51-84320A55 | type LM565CN |
| U803 | 51-84320A79 | type CA3096AE |
| <u>NETWORK:</u> | | |
| Z801 | 51-82142K02 | resistive |
| <u>CRYSTAL:</u> | | |
| Y801 | 48-82003K01 | resonator 50.00000- 50.000000KH |

| | |
|-------------|----------------------|
| 30 10184434 | CONTACT - whole form |
|-------------|----------------------|

| | |
|-------------|---------------------|
| 37-82603D02 | SLEEPING, coded #2 |
| 37-82603D06 | SLEEPING, coded #6 |
| 37-82603D07 | SLEEPING, coded #7 |
| 37-82603D08 | SLEEPING, coded #8 |
| 37-82603D09 | SLEEPING, coded #9 |
| 37-82603D10 | SLEEPING, coded #10 |
| 37-82603D11 | SLEEPING, coded #11 |
| 37-82603D13 | SLEEPING, coded #13 |
| 37-82603D14 | SLEEPING, coded #14 |
| 37-82603D16 | SLEEPING, coded #16 |
| 37-82603D17 | SLEEPING, coded #17 |
| 37-82603D18 | SLEEPING, coded #18 |
| 37-82603D19 | SLEEPING, coded #19 |

NOTE: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

| | | |
|---|------------|---|
| J801 | 9-82071K01 | SOCKET: female; 12 contact |
| Q801, 806, 807, 811, 813, 816, 817 | 48-869643 | TRANSISTOR: (SEE NOTE) PNP; type M9643 |
| Q802, 805, 812, 815, 821 | 48-869642 | NPN; type M9642 |
| Q803 | 48-869642 | NPN; type M9642 (TLN5817AV only) |
| Q804 | 48-869648 | field-effect |
| Q814 | 48-869648 | NPN; type M9648 |
| Q818 | 48-869649 | NPN; type M9649 |
| RESISTOR, fixed: $\pm 5\%$; 1/4 W unless otherwise stated | | |
| R801 | 6-12A474 | 11k |
| R802, 844 | 6-12A437 | 13k |
| R803, 853 | 6-12A449 | 130 |
| R804, 805, 808, 813 | 6-12A497 | 100k |
| R806, 854 | 6-12A445 | 680 |
| R807, 831 | 6-12A802 | 150k |
| R809 | 6-12A491 | 56k |
| R810 | 6-12A473 | 10k (TLN5817AV only) |
| R811, 812 | 6-12A489 | 47k (TLN5817AV only) |
| R814 | 6-12A804 | 10k |
| R815, 817, 827 | 6-12A814 | 470k |
| R816 | 6-12A477 | 15k |
| R818, 841 | 6-12C49V | 120k $\pm 10\%$ |
| R819, 840, 842 | 6-12C495 | 82k $\pm 10\%$ |
| R820, 821 | 6-12C489 | 1.8k |
| R822 | 6-12C495V | 2.7k $\pm 10\%$ |
| R823, 830, 848 | 6-12A483 | 27k |
| R824, 829, 836, 839, 845, 846 | 6-12A473 | 10k |
| R825 | 6-12A459 | 2.7k |
| R826 | 6-10621D80 | 56, 2k $\pm 1\%$; 1/8 W |
| R829, 833, 847 | 6-12A489 | 47k |
| R832 | 6-12A493 | 68k |
| R834, 835, 836 | 6-13795D64 | 56, 2k $\pm 1\%$ |
| R837 | 6-12A455 | 1.8k |
| R843 | 6-12A413 | 12k |
| R849, 852, 859 | 6-12C475 | 220 $\pm 10\%$ |
| R850, 855 | 6-12A453 | 1.5k |
| R851 | 6-12A479 | 18k |
| R854 | 6-12A455 | 1.5k $\pm 10\%$ |

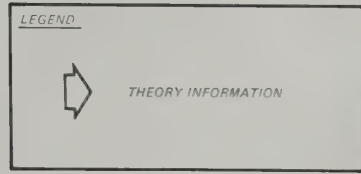


| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|------------------|-------------------|-------------|
|------------------|-------------------|-------------|

PARTS LIST

| | | |
|-------------------------------|-------------|--|
| TLN5730A 2-Code Adapter Board | | PL-3414-O |
| CR850 thru 867 | 48-83654H01 | DIODE: (SEE NOTE) silicon |
| J850, 851 | 9-82071K01 | CONNECTOR, receptacle: female; 12-contact |
| P850 | | CONNECTOR, plug: consists of: 28-82070K01 CONTACT, male; 13 req'd. |
| Q850, 851 | 48-869642 | TRANSISTOR: (SEE NOTE) NPN; type M9642 |
| R850, 852, 853, 856 | 6-124A73 | RESISTOR, fixed: 10k $\pm 5\%$; 1/4 W |
| R851, 854 | 6-124A65 | 4.7k $\pm 5\%$; 1/4 W |
| NON-REFERENCED ITEMS | | |
| | 1V80769B88 | CIRCUIT BOARD ASSY., incl. referenced item P850 |
| | 3-138804 | SCREW, machine: 4-40 x 5/16"; 2 req'd. |

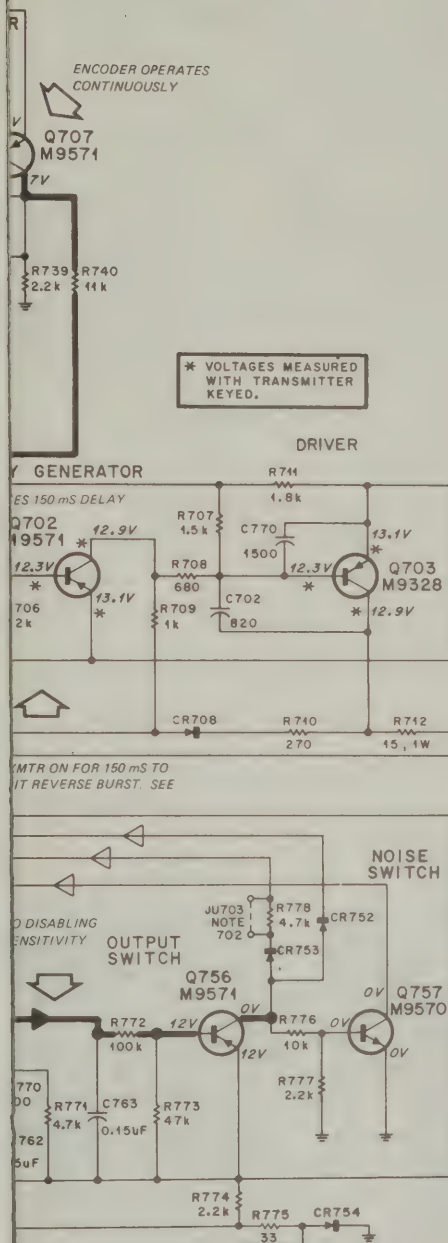
NOTE: For optimum performance, diodes and transistors must be ordered by Motorola part number.



APPLICATION -

Plugs into code plug receptacle on "Digital Private-Line" Decoder or Encoder-Decoder to allow separate digital "Private-Line" codes for transmit and receive. Code plugs for the two codes then plug into the receptacles on the two-code adapter board.

Model TLN5730A "Digital Private-Line" Two-Code Adapter Schematic Diagram and Circuit Board Detail
Motorola No. 68P81106E97-A
8/20/75-PO



NOTES:

701. DETERMINES TONE OUTPUT LEVEL: FACTORY DETERMINED.
702. THE RADIO IS SHIPPED WITH JUMPER JU702 OUT AND JU703 IN. IN THIS MODE THE "PL" SQUELCH SENSITIVITY IS TIED TO THE CARRIER SQUELCH SENSITIVITY. THUS THE "PL" SQUELCH SENSITIVITY IS VARIABLE WITH SQUELCH CONTROL. IF DESIRED, THE RADIO CAN BE WIRED SO THE "PL" SQUELCH SENSITIVITY IS INDEPENDENT OF CARRIER SQUELCH CONTROL. TO ACCOMPLISH THIS, INSERT JUMPER JU702 AND REMOVE JUMPER JU703.
703. UNLESS OTHERWISE STATED, ALL CAPACITOR VALUES ARE IN PICOFARADS, RESISTOR VALUES ARE IN OHMS, ALL RESISTORS ARE 1/4 WATT.
704. DC VOLTAGES TAKEN WITH 20K OHMS PER VOLT MULTIMETER WITH RESPECT TO GROUND.

LEGEND



THEORY OF OPERATION DATA



= PRIMARY SIGNAL FLOW

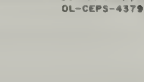
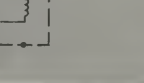
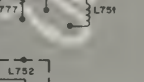
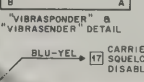
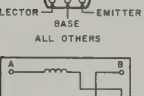
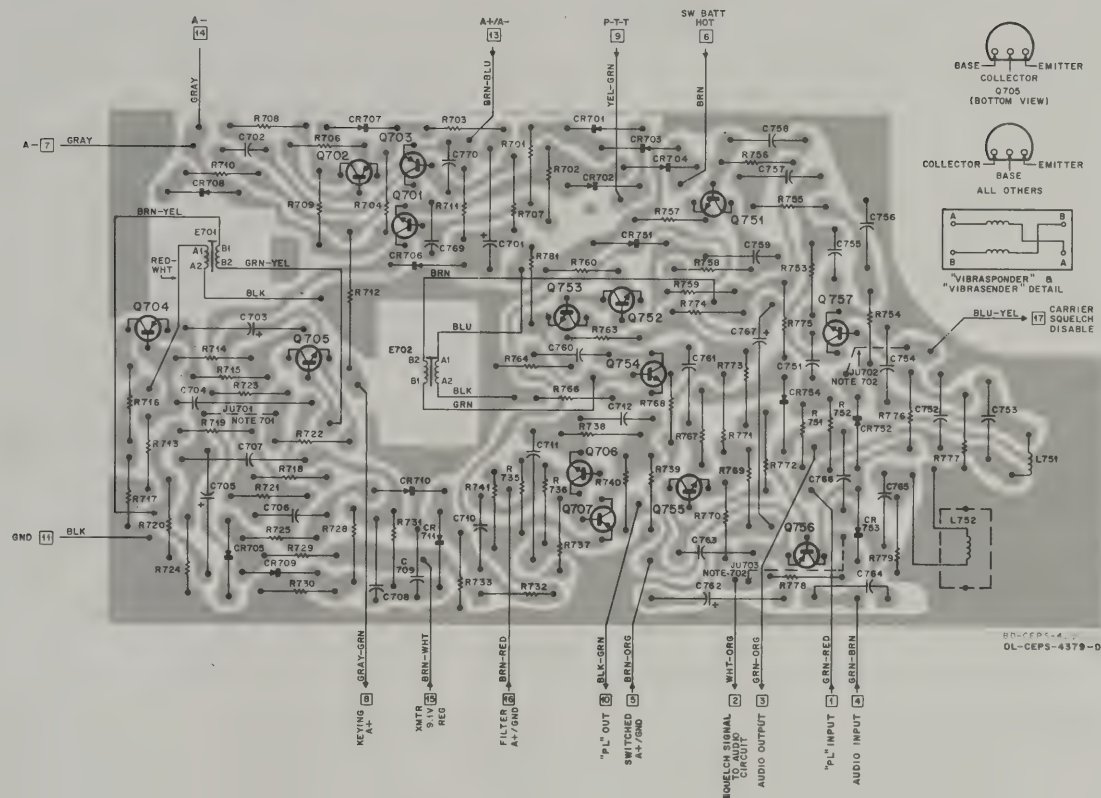


= SECONDARY SIGNAL FLOW

PARTS LIST & NOTES SHOWN ON TRANSMITTER-RECEIVER SCHEMATIC & INTERCABLING DIAGRAM

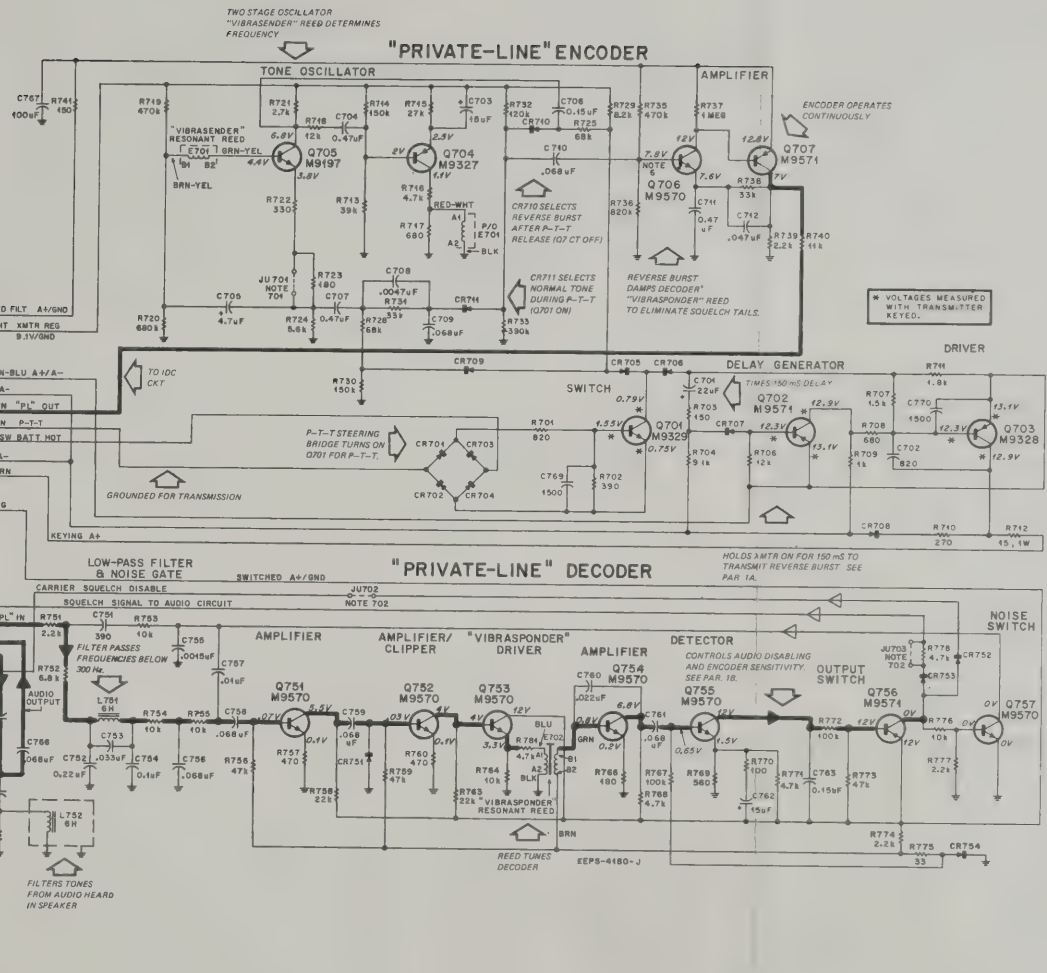
TLN4448A-2 "Private-Line" Encoder & Decoder
Circuit Board Detail
Motorola No. PEPS-4849-F
8/20/75-PO

"PL" ENCODER-DECODER

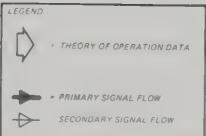


| CHASSIS AND SUFFIX NO. | REF. SYMBOL | CHANGE | LOCATION |
|------------------------|-------------|--|----------|
| TLN4448A-1 | C751 | FROM 270 pF TO 100 pF | A4 |
| | R769 | FROM 680 Ohms TO 510 Ohms | B3 |
| TLN4448A-2 | C701 | FROM 23-54752103 10 uF TO 23-84762116 22 uF | A2 |
| | R704 | FROM 6-124A80 820 Ohms TO 6-124A72 9.1k Ohms | |

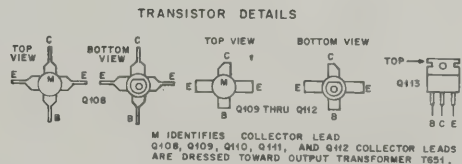
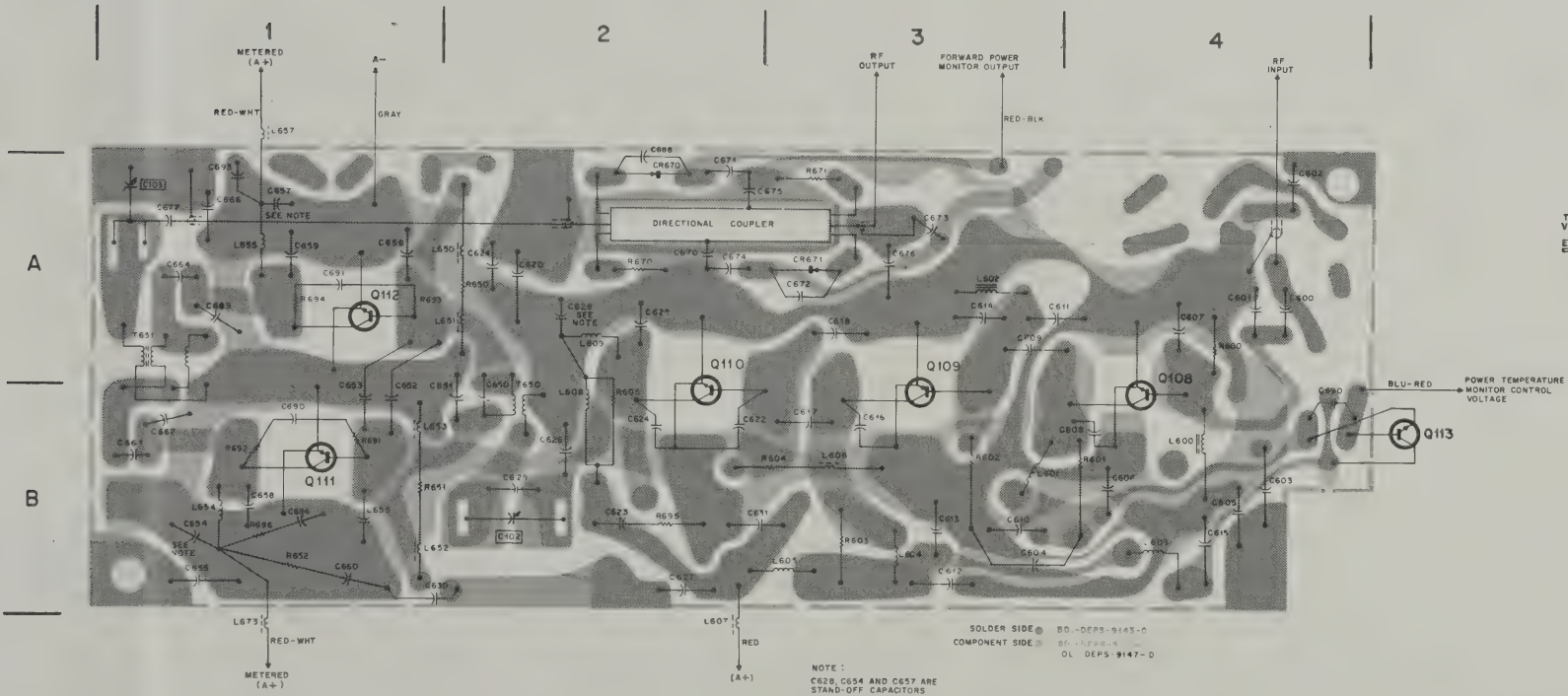
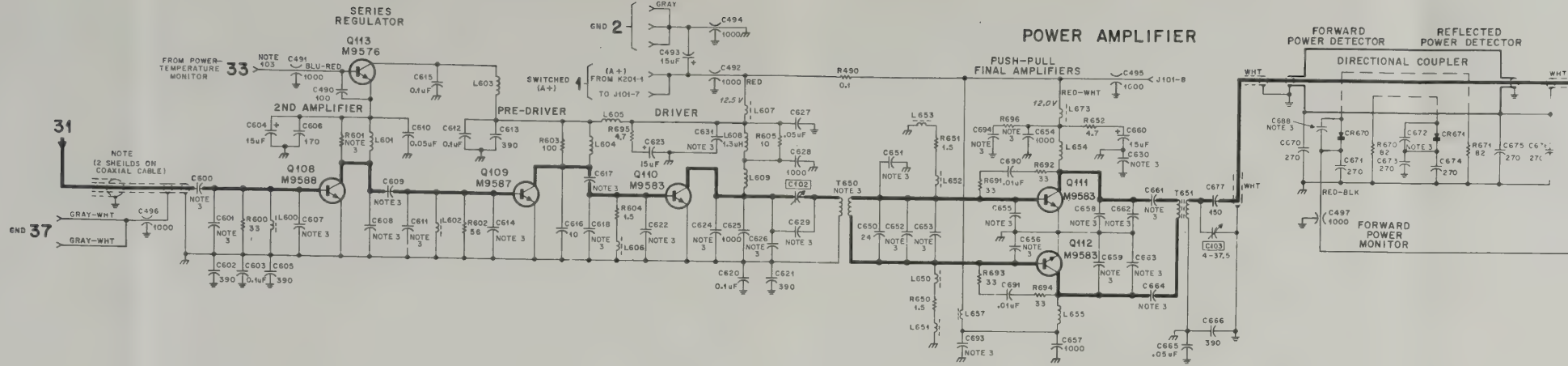
REVISIONS PEPS-4849-F



NOTES
 701 DETERMINES TONE OUTPUT LEVEL FACTORY DETERMINED
 702 THE RADIO IS SHIPPED WITH JUMPER J702 OUT AND J703 IN. IN THIS MODE THE "PL" SQUELCH SENSITIVITY IS TIED TO THE CARRIER SQUELCH SENSITIVITY. THUS THE "PL" SQUELCH SENSITIVITY IS VARIABLE WITH SQUELCH CONTROL. IF DESIRED, THE RADIO CAN BE WIRED SO THE "PL" SQUELCH SENSITIVITY IS INDEPENDENT OF CARRIER SQUELCH CONTROL. TO ACCOMPLISH THIS, INSERT JUMPER J702 AND REMOVE JUMPER J703.
 703 UNLESS OTHERWISE STATED, ALL CAPACITOR VALUES ARE IN PICOFARADS. RESISTOR VALUES ARE IN OHMS. ALL RESISTORS ARE 1/4 WATT.
 704 DC VOLTAGES TAKEN WITH 20K OHMS PER VOLT MULTIMETER WITH RESPECT TO GROUND.



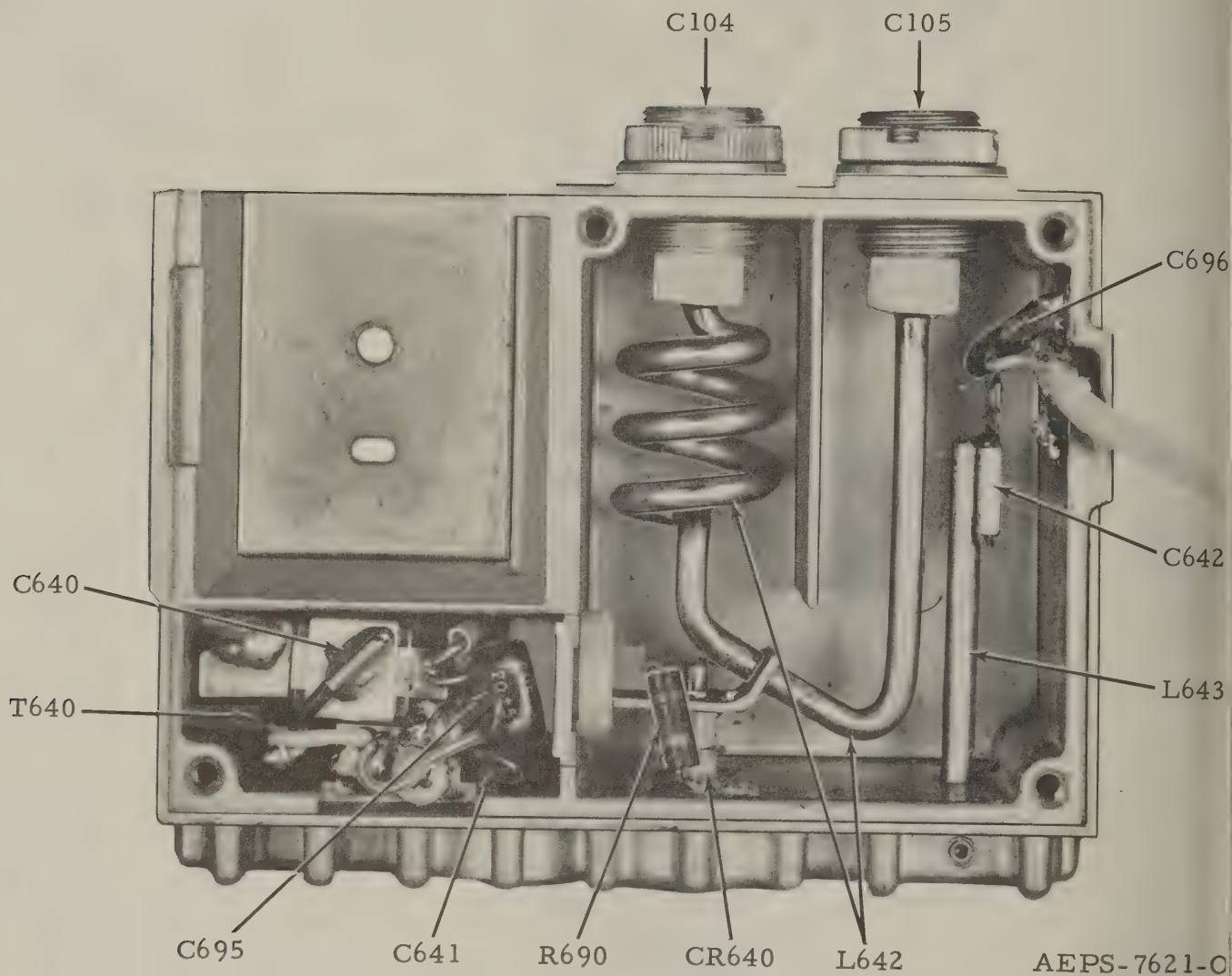
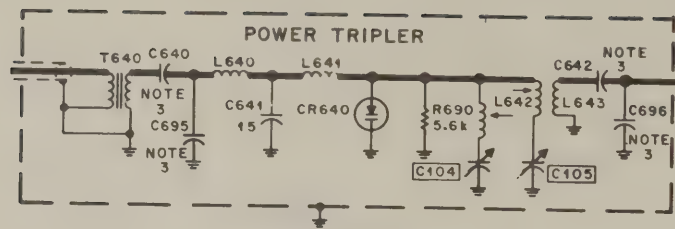
PARTS LIST & NOTES SHOWN ON TRANSMITTER-RECEIVER SCHEMATIC & INTERCABLING DIAGRAM
 TLN4448A-2 "Private-Line" Encoder & Decoder Circuit Board Detail
 Motorola No. PEPS-4849-F
 8/20/75-PO



| POWER AMPLIFIER KEYING NUMBERS | | | |
|--------------------------------|---------|-----------|---------|
| REF. SYM. | KEY NO. | REF. SYM. | KEY NO. |
| C102 | B2 | C670 | A2 |
| C103 | A1 | C671 | A1 |
| C490 | B4 | C672 | A3 |
| C600 | A4 | C673 | A3 |
| C601 | A4 | C674 | A2 |
| C602 | A4 | C675 | A2 |
| C603 | B4 | C676 | A3 |
| C604 | B3 | C677 | A1 |
| C605 | B4 | C688 | A2 |
| C606 | B4 | C690 | B1 |
| | | C691 | A1 |
| C607 | A4 | C693 | A1 |
| C608 | B4 | C694 | B1 |
| C609 | A3 | CR670 | A2 |
| C610 | B3 | CR671 | A3 |
| C611 | A3 | L600 | B4 |
| C612 | B3 | L601 | B3 |
| C613 | B3 | L602 | A3 |
| C614 | A3 | L603 | B4 |
| C615 | B4 | L604 | B3 |
| C616 | B3 | L605 | B3 |
| | | L606 | B3 |
| | | L607 | B2 |
| C617 | B3 | L608 | B2 |
| C618 | A3 | L609 | A2 |
| C620 | A2 | L650 | A2 |
| C621 | A2 | L651 | A2 |
| C622 | B2 | L652 | B1 |
| C623 | B2 | L653 | B1 |
| C624 | B2 | L654 | B1 |
| C625 | A2 | L657 | A1 |
| C626 | B2 | L673 | B1 |
| C627 | B2 | Q108 | B4 |
| | | Q109 | B3 |
| C628 | A2 | Q110 | B2 |
| C629 | B2 | Q111 | B1 |
| C630 | B1 | Q112 | A1 |
| C631 | B2 | Q113 | B4 |
| C650 | B2 | R600 | A4 |
| C651 | B2 | R601 | B4 |
| C652 | B1 | R602 | B3 |
| C653 | B1 | R604 | B3 |
| C654 | B1 | R605 | B2 |
| C655 | B1 | R650 | A2 |
| C656 | A1 | R651 | B1 |
| C657 | A1 | R670 | A2 |
| C658 | B1 | R671 | A3 |
| C659 | A1 | R691 | B1 |
| C660 | B1 | R692 | B1 |
| C661 | B1 | R693 | A1 |
| C662 | B1 | R694 | A1 |
| C663 | A1 | R695 | B2 |
| C664 | A1 | R696 | B1 |
| C665 | B1 | T650 | B2 |
| C666 | A1 | T651 | A1 |

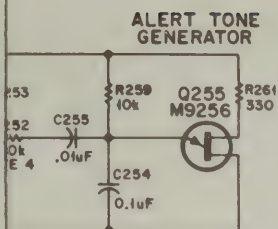
PARTS LIST & NOTES SHOWN ON TRANSMITTER-RECEIVER SCHEMATIC & INTERCABLEING DIAGRAM
 Model TLE1550A Series Power Amplifier
 Circuit Board Detail
 Motorola No. PEPS-9181-E
 8/20/75-PO

EPS-5281-C



PARTS LIST SHOWN ON
TRANSMITTER-RECEIVER
SCHEMATIC & INTERCABLING
DIAGRAM

TLE6570A Series Power Tripler
Parts Location Detail
Motorola No. PEPS-4866-A
8/20/75-PO



CEPS-4860-0

NOTES:

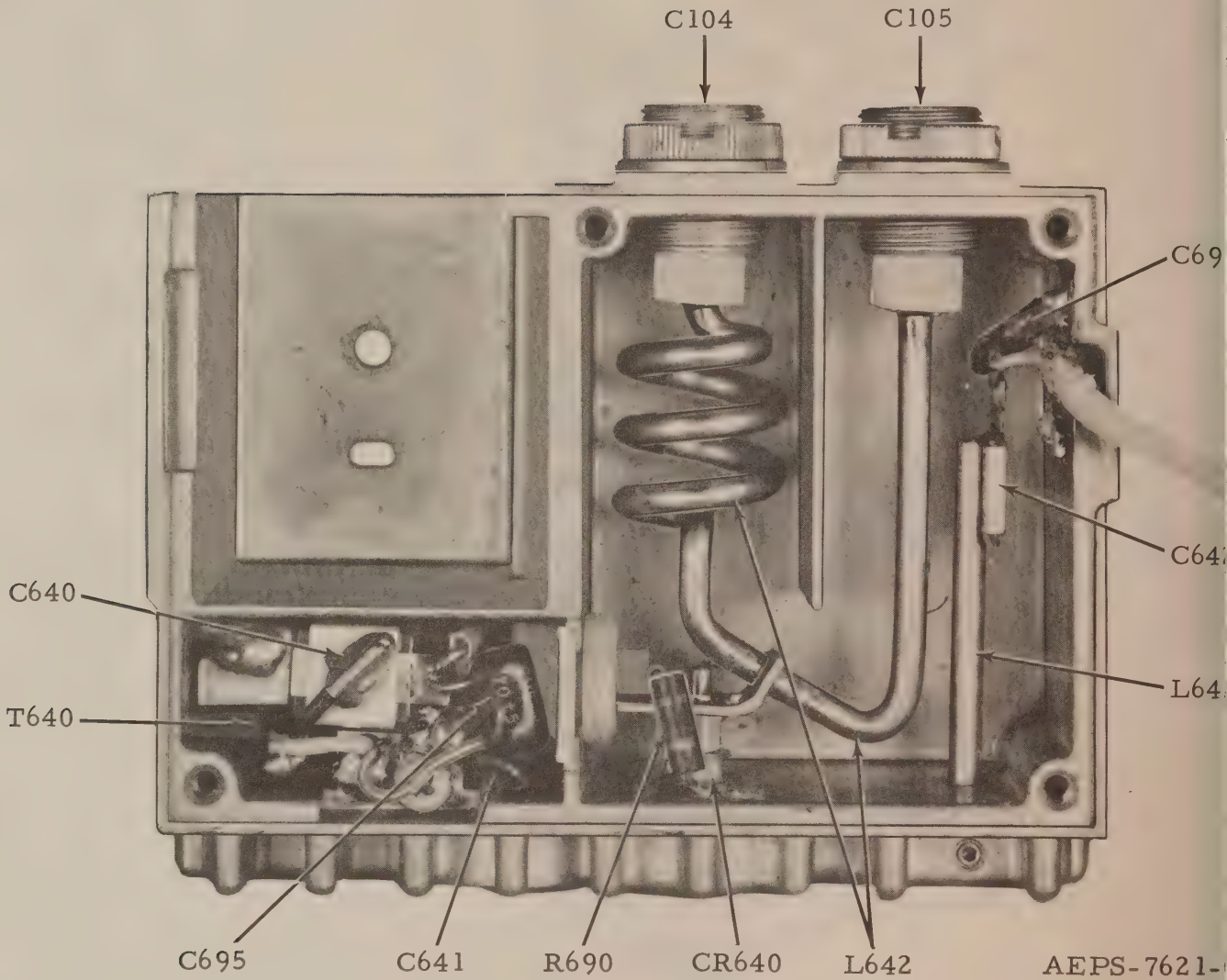
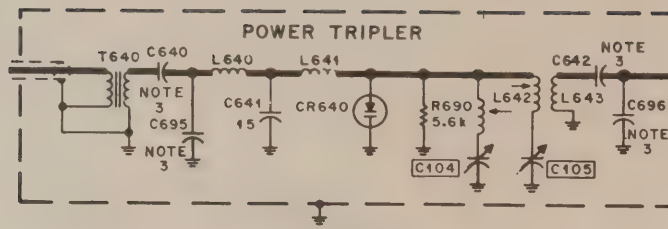
1. VOLTAGE READING CONDITIONS, [] = TRANSMITTER KEYED READING, () = TIMED-OUT READING.
2. TIME-OUT TIMER AND CONNECTIONS ARE OPTIONAL. Q250, R252, AND J250 ARE NOT SUPPLIED UNLESS UNIT IS FACTORY EQUIPPED WITH TIME-OUT TIMER.
3. A COMPONENT (CR104) IS OMITTED FROM TRANSMITTER IN UNITS EQUIPPED WITH TIME-OUT TIMER.
4. DECREASE VALUE OF R252 TO INCREASE VOLUME OF OUTPUT ALERT TONE.

| R252 VALUE | SPEAKER OUTPUT VARIATIONS IN dB |
|------------|------------------------------------|
| 47k | +10.1 |
| 56k | + 8.4 |
| 68k | + 7.2 |
| 100k | + 5.8 |
| 150k | Reference (100 n.V) |
| 270k | - 2.5 |
| 330k | - 4.0 |
| 470k | - 5.8 |
| 680k | -10.4 |

| TLN1097A T-O-T | | |
|-------------------------|---------------------------|-------------------------------|
| TLN8403A T-O-T BOARD | TLN8404 COMPONENTS KIT | TLN4323A T-O-T ADAPTER KIT |

EPS-4863-0

Time-Out Timer & Adapter Kit
Schematic Diagram & Circuit Board Detail
Motorola No. 63P81011E48-O
8/20/75-PO



PARTS LIST SHOWN ON
TRANSMITTER-RECEIVER
SCHEMATIC & INTERCABLING
DIAGRAM

TLE6570A Series Power Tripler
Parts Location Detail
Motorola No. PEPS-4866-A
8/20/75-PO

| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|------------------|-------------------|-------------|
|------------------|-------------------|-------------|

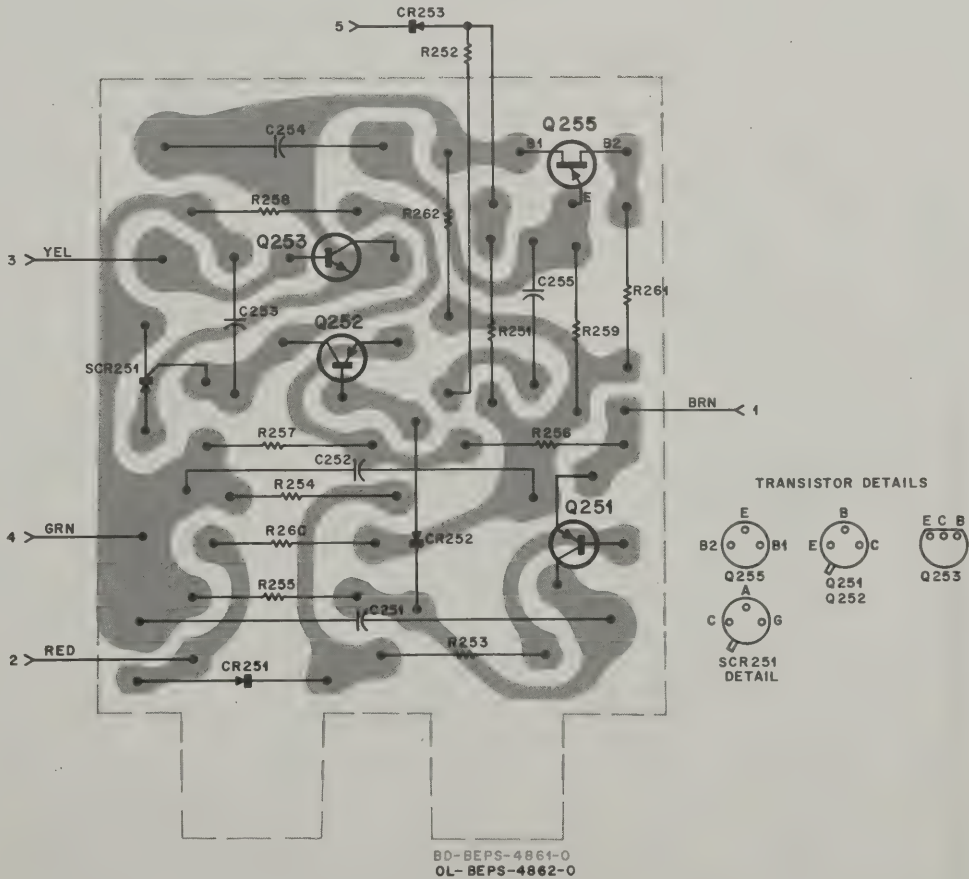
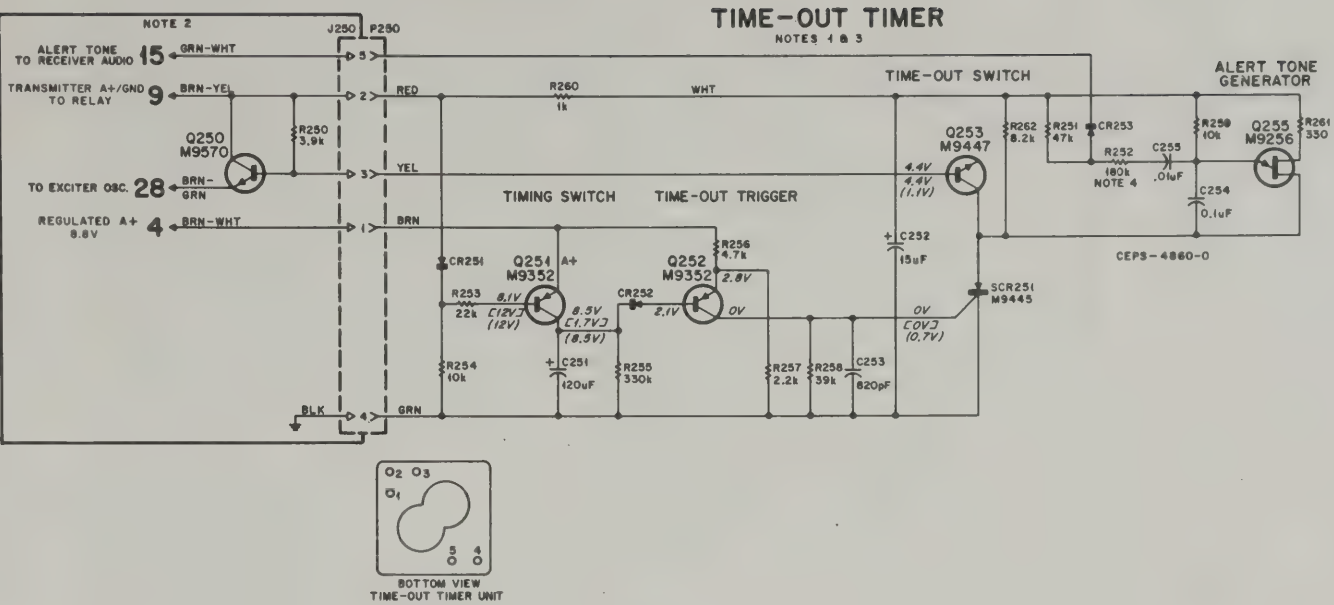
PARTS LIST

IMPORTANT
 USE ONLY THE FOLLOWING MOTOROLA
 PART NUMBERS WHEN ORDERING
 REPLACEMENT PARTS

| | | |
|-------------------------|------------------------|---|
| TLN1097A Time-Out Timer | | PL-1118-O |
| C251 | 23D83185D01 | CAPACITOR, fixed: uF ±10%; unl. stated 120; 15 V 15 ±20%; 25 V 820 pF; 500 V 0.1; 50 V .01 ±20%; 200 V |
| C252 | 23D83214C07 | |
| C253 | 21C82187B17 | |
| C254 | 8D83293B01 | |
| C255 | 21D82428B59 | |
| CR251 | 48C82392B03 | <u>SEMICONDUCTOR DEVICE,</u> <u>diode:</u> (SEE NOTE) silicon silicon silicon |
| CR252 | 48C82392B09 | |
| CR253 | 48C82392B03 | |
| Q251 | 48R869352 | <u>TRANSISTOR:</u> (SEE NOTE) P-N-P; type M9352 P-N-P; type M9352 N-P-N; type M9447 unijunction; type M9256 |
| Q252 | 48R869352 | |
| Q253 | 48R869447 | |
| Q255 | 48R869256 | |
| R251 | 6S128902 | <u>RESISTOR, fixed: ±10%; 1/4 W;</u> unl. stated 47K 180K 22K 10K 330K ±5% 4.7K ±5% 2.2K ±5% 39K 10K 1K 330 8.2K |
| R252 | 6S129229 | |
| R253 | 6S128685 | |
| R254 | 6S129225 | |
| R255 | 6S129473 | |
| R256 | 6S129669 | |
| R257 | 6K129804 | |
| R258 | 6K128903 | |
| R259 | 6S129225 | |
| R260 | 6S127802 | |
| R261 | 6S129775 | |
| R262 | 6S128686 | |
| SCR251 | 58R869445 | |
| | | |
| NON-REFERENCED ITEMS | | |
| | 1V80763A66 TLN8403A | SOCKET ASSY. timer board CIRCUIT BOARD ASSEMBLY; does not include CR253, R252 |

| | | |
|---------------------------|---------------------------------------|---|
| TLN4323A Installation Kit | | PL-1021-O |
| Q250 | 48R869570 | TRANSISTOR; (SEE NOTE) N-P-N; type M9570 |
| R250 | 6S129232 | RESISTOR, fixed; 3.9k $\pm 10\%$; 1/4 W |
| NON-REFERENCED ITEMS | | |
| | 1V80708B80 41A82114E01 3S134184 | CIRCUIT BOARD ASSY. SPRING, crystal hold-down SCREW, tapping: No. 4-40 x 5/16" |

NOTE:
 Replacement diodes and transistors must be ordered by
 Motorola part number only for optimum performance.



- NOTES:
- VOLTAGE READING CONDITIONS, [] = TRANSMITTER KEYPED READING, () = TIMED-OUT READING.
 - TIME-OUT TIMER AND CONNECTIONS ARE OPTIONAL. Q250, R252, AND J250 ARE NOT SUPPLIED UNLESS UNIT IS FACTORY EQUIPPED WITH TIME-OUT TIMER.
 - A COMPONENT (CR104) IS OMITTED FROM TRANSMITTER IN UNITS EQUIPPED WITH TIME-OUT TIMER
 - DECREASE VALUE OF R252 TO INCREASE VOLUME OF OUTPUT ALERT TONE.

| R252 VALUE | SPEAKER OUTPUT VARIATIONS IN dB |
|------------|---------------------------------|
| 47k | -1.0 |
| 180k | -1.4 |
| 22k | -1.5 |
| 10k | -2.0 |
| 330k ±5% | -2.5 |
| 4.7k ±5% | -2.5 |
| 2.2k ±5% | -2.5 |
| 39k | -6.0 |
| 10k | -9.0 |
| 1k | -13.0 |

| | |
|----------------------|----------------|
| TLN1097A T | TLN4323A T-O-T |
| TLN8403A T-O-T BOARD | ADAPTER KIT |

EPS-4863-O

Time-Out Timer & Adapter Kit
 Schematic Diagram & Circuit Board Detail
 Motorola No. 63P81011E48-O
 8/20/75-PO

PARTS LIST

TLN8482A Ground Reversing Kit

EPD-14846-D

| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|------------------|-------------------|------------------------------------|
| C201, 202, 205 | 23K865136 | CAPACITOR, fixed: uF |
| C204 | 21D82428B40 | 15 \pm 20%; 25 V |
| C207 | 23K865137 | .01 +60-40%; 250 V |
| | | 4.7 \pm 20%; 25 V |
| | | SEMICONDUCTOR DEVICE, |
| | | diode: (SEE NOTE) |
| CR201 | 48C82525G07 | silicon |
| CR202 | 48C82466H01 | silicon |
| CR204, 205 | 48C82466H12 | silicon |
| CR203, 206 | 48C82392B03 | silicon |
| | | COIL, audio: choke |
| L201 | 25B82142H01 | 5 mH |
| | | CONNECTOR, plug: ass'y; |
| P201 | 1V80735A23 | male; 15 contact; includes |
| | | 14C82141H01 INSULATOR, |
| | | 29C82335A01 TERMINAL |
| | | TRANSISTOR: (SEE NOTE) |
| Q201, 202 | 48R869428 | N-P-N; type M9428 |
| Q203 | 48R869427 | P-N-P; type M9427 |
| Q204 | 48R869350 | N-P-N; type M9350 |
| | | RESISTOR, fixed: \pm 10%; 1/4 W; |
| | | unl. stated |
| R201 | 6S131652 | 39 |
| R202 | 6S129269 | 1.8K |
| R203 | 6S129226 | 100K |
| R204 | 6K127802 | 1K |
| R205 | 6S6040 | 680; 1/2 W |
| R206 | 6S129230 | 12K |
| R207 | 6S129145 | 82K |
| | | TRANSFORMER: |
| T201 | 25D83633D01 | pri. No. 1: BLU, YEL w/center |
| | | tap @ WHT; total coil res. .087 |
| | | ohms |
| | | pri. No. 2: BRN, BLK w/center |
| | | tap @ GRN; total coil res. 0.16 |
| | | ohms |
| | | sec: ORG, ORG w/center tap @ |
| | | RED; total coil res. 0.339 |

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

TABLE I.

"PRIVATE-LINE" ENCODER MEASUREMENTS

| METERING POINT | TYPICAL AUDIO VOLTAGES |
|----------------------------------|------------------------|
| Tone Oscillator, Q704, Base | 180 mV rms |
| Tone Oscillator, Q704, Collector | 1.2 V rms |
| Across Reed Primary, B1 to B2 | 60 mV rms |
| Across Reed Secondary, A1 to A2 | 100 mV rms |
| Tone Oscillator, Q705, Base | 0.85 V rms |
| Tone Oscillator, Q705, Collector | 0.4 V rms |
| Tone Oscillator, Q705, Emitter | 0.85 V rms |
| PL Amplifier, Q706, Base | .35 V rms |
| PL Amplifier, Q706, Emitter | .35 V rms |
| PL Amplifier, Q706, Collector | 25 mV rms |
| PL Amplifier, Q707, Collector | 3.2 V rms |
| PL Tone Output (BLK-GRN WIRE) | 0.60 V rms |

NOTES:

- Readings may be taken without keying transmitter.
- All readings taken with Motorola AC Voltmeter are referenced to chassis.

EPS-4792-O

TABLE II.

"PRIVATE-LINE" DECODER MEASUREMENTS

| METERING POINT | TYPICAL READING* |
|---------------------------------------|------------------|
| Decoder Board Input (GRAY-GRN lead) | 60 mV rms |
| PL Amplifier, Base (Q751) | 10 mV rms |
| PL Amplifier, Collector (Q751) | 220 mV rms |
| Amplifier/Clipper, Base (Q752) | 2.8 V rms |
| Amplifier/Clipper, Collector (Q752) | 2.8 V rms |
| "Vibrasponder" Driver, Base (Q753) | 540 mV rms |
| "Vibrasponder" Driver, Emitter (Q753) | 500 mV rms |
| Amplifier, Base (Q754) | 100 mV rms |
| Amplifier, Collector (Q754) | 2.0 V rms |
| Detector, Base (Q755) | 1.8 V rms |
| Detector, Collector (Q755) | 2.7 V dc |
| Output Switch, Base (Q756) | 11.4 V dc |
| Output Switch, Collector (Q756) | 11.9 V dc |
| Noise Switch, Base (Q757) | 0.7 V dc |

*Readings taken with 1000-mV input rf signal and 0.5-kHz PL tone deviation.

EPS-4793-A

TABLE III.

TRANSMITTER AUDIO AND RF VOLTAGE READINGS

| METERING POINT | TYPICAL VOLTAGE READINGS (rms) | | |
|--|--------------------------------|--------|-----------|
| | Emitter | Base | Collector |
| Audio Amplifier (Q101) Note 1 | 40 mV | 40 mV | 180 mV |
| Clipper (Q102) Note 1 | --- | 7.6 mV | 1.3 V |
| Emitter Follower (Q103) Note 1 | 1.1 V | --- | --- |
| Oscillator(s) (Q104, Q119, Q120, Q121) | --- | --- | 1.7 V |
| Buffer (Q105) | --- | 0.8 V | 4.0 V |
| Tripler (Q106) | --- | 3.0 V | 5.3 V |
| 1st Amplifier (Q107) | --- | 1.5 V | 9.0 V |
| 2nd Amplifier (Q108) | --- | 3.5 V | 5.0 V |
| Pre-Driver (Q109) | --- | 2.5 V | 9.0 V |
| Driver (Q110) | --- | 6.0 V | 12.0 V |
| Final Amplifiers (Q111, Q112) | --- | 8.0 V | 14.0 V |

NOTES:

- Audio readings are taken with 0.1 V rms of 1000-Hz tone applied at the microphone connector.
- All voltages measured with respect to chassis ground.
- Supply voltage = 13.6 V dc.

TABLE IV.

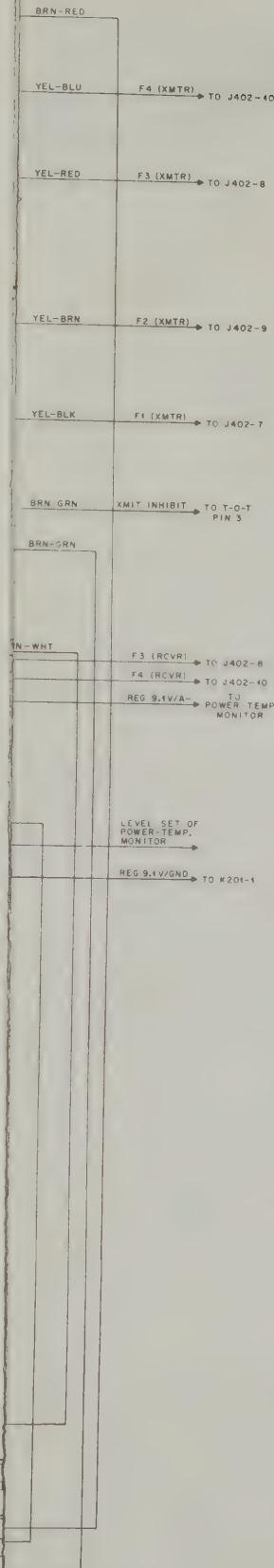
TYPICAL RECEIVER GAIN DISTRIBUTION

| METERING POINT | RF VOLTAGE AT ANTENNA CONNECTOR | NOMINAL RF VOLTAGE AT METERING POINT |
|----------------------------|---------------------------------|--------------------------------------|
| 1st Mixer Drain (Q1) | 25 mV | 0.50 V |
| 11.7 MHz IF Base (Q5) | 25 mV | .23 V |
| 11.7 MHz IF Collector (Q5) | 25 mV | 0.30 V |
| 2nd Mixer Base (Q6) | 25 mV | 0.12 V |
| 2nd Mixer Collector (Q6) | 1 mV | 0.25 V |

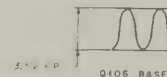
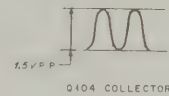
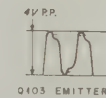
NOTES:

- All voltages referenced to chassis ground.
- DC Supply Voltage = 13.8 V dc
- All voltages measured with Motorola Model S1052B DC Multimeter using the SLN6055A RF Probe.
- Multiply all voltages by 2 when preamplifier is used.

EPS-4



EXCITER SECTION WAVEFORMS



AUDIO CIRCUIT WAVEFORMS
WITH A 1.0 VOLT 1000Hz TONE
APPLIED AT MICROPHONE INPUT

B-Suffix Main Board Models
Circuit Board Detail
Motorola No. PEPS-16936-A
8/20/75-PO

PARTS LIST

TLN8482A Ground Reversing Kit

EPD-14846-D

| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION |
|------------------|-------------------|--------------------------------------|
| C201, 202, 205 | 23K865136 | CAPACITOR, fixed: uF |
| C204 | 21D82428B40 | 15 $\pm 20\%$; 25 V |
| C207 | 23K865137 | .01 $\pm 60-40\%$; 250 V |
| | | 4.7 $\pm 20\%$; 25 V |
| | | SEMICONDUCTOR DEVICE, |
| | | diode: (SEE NOTE) |
| CR201 | 48C82525G07 | silicon |
| CR202 | 48C82466H01 | silicon |
| CR204, 205 | 48C82466H12 | silicon |
| CR203, 206 | 48C82392B03 | silicon |
| | | COIL, audio: choke |
| L201 | 25B82142H01 | 5 mH |
| | | CONNECTOR, plug: ass'y; |
| P201 | 1V80735A23 | male; 15 contact; includes |
| | | 14C82141H01 INSULATOR, |
| | | 29C82335A01 TERMINAL |
| | | TRANSISTOR: (SEE NOTE) |
| Q201, 202 | 48R869428 | N-P-N; type M9428 |
| Q203 | 48R869427 | P-N-P; type M9427 |
| Q204 | 48R869350 | N-P-N; type M9350 |
| | | RESISTOR, fixed: $\pm 10\%$; 1/4 W; |
| | | unl. stated |
| R201 | 6S131652 | 39 |
| R202 | 6S129269 | 1.8K |
| R203 | 6S129226 | 100K |
| R204 | 6K127802 | 1K |
| R205 | 6S6040 | 680; 1/2 W |
| R206 | 6S129230 | 12K |
| R207 | 6S129145 | 82K |
| | | TRANSFORMER: |
| T201 | 25D83633D01 | pri. No. 1: BLU, YEL w/center |
| | | tap @ WHT; total coil res. .087 |
| | | ohms |
| | | pri. No. 2: BRN, BLK w/center |
| | | tap @ GRN; total coil res. 0.16 |
| | | ohms |
| | | sec: ORG, ORG w/center tap @ |
| | | RED; total coil res. 0.339 |

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

| METERING POINT | TYPICAL AUDIO VOLTAGES |
|----------------------------------|------------------------|
| Tone Oscillator, Q704, Base | 14 mV rms |
| Tone Oscillator, Q704, Collector | 1.2 V rms |
| Across Reed Primary, B1 to B2 | 40 mV rms |
| Across Reed Secondary, A1 to A2 | 100 mV rms |
| Tone Oscillator, Q706, Base | 0.85 V rms |
| Tone Oscillator, Q706, Collector | 1.2 V rms |
| PL Amplifier, Q706, Base | 0.85 V rms |
| PL Amplifier, Q706, Emitter | 2.35 V rms |
| PL Amplifier, Q706, Collector | 25 mV rms |
| PL Amplifier, Q707, Collector | 3.2 V rms |
| PL Tone Output (BLK-GRN WIRE) | 0.60 V rms |

NOTES:
1. Readings may be taken without keying transmitter.
2. All readings taken with Motorola AC Voltmeter are referenced to chassis.

EPS-4792-O

| METERING POINT | TYPICAL READING* |
|--|------------------|
| Injection Board Input (PDAV) (Q751) Lead | 40 mV rms |
| PL Amplifier, Base (Q751) | 10 mV rms |
| PL Amplifier, Collector (Q751) | 220 mV rms |
| Amplifier/Clipper, Base (Q752) | 2.8 V rms |
| Amplifier/Clipper, Collector (Q752) | 2.8 V rms |
| Vibrasponder Driver, Base (Q753) | 540 mV rms |
| Vibrasponder Driver, Emitter (Q753) | 500 mV rms |
| Amplifier, Base (Q754) | 100 mV rms |
| Amplifier, Collector (Q754) | 2.0 V rms |
| Detector, Base (Q755) | 1.8 V rms |
| Detector, Collector (Q755) | 2.7 V dc |
| Output Switch, Base (Q756) | 11.4 V dc |
| Output Switch, Collector (Q756) | 11.9 V dc |
| Noise Switch, Base (Q757) | 0.7 V dc |

*Measurements taken with 1000-mHz input rf signal and 0.5 kHz PL tone deviation.

EPS-4793-A

| METERING POINT | TYPICAL VOLTAGE READINGS (rms) |
|-------------------------------------|----------------------------------|
| | Emitter Base Collector |
| Audio Amplifier (Q101) Note 1 | 1.5 mV 4.0 mV 130 mV |
| Clipper (Q102) Note 1 | --- 7.6 mV 1.3 V |
| Emitter Follower (Q103) Note 1 | 1.1 V --- --- |
| Oscillator (Q104, Q109, Q126, Q127) | --- 0.8 V 1.7 V |
| Driver (Q105) | --- 3.0 V 5.3 V |
| Driver (Q106) | --- 1.5 V 9.0 V |
| Driver (Q107) | --- 3.5 V 5.0 V |
| Driver (Q108) | --- 2.5 V 9.0 V |
| Driver (Q109) | --- 6.0 V 12.0 V |
| Driver (Q110) | --- 8.0 V 14.0 V |

NOTES:
1. Audio readings are taken with 0.1 V rms of 1000-Hz tone applied at the microphone connector.
2. All voltages measured with respect to chassis ground.
Supply voltage = 13.6 V dc.

| METERING POINT | RF VOLTAGE AT ANTENNA CONNECTOR | NOMINAL RF VOLTAGE AT METERING POINT |
|----------------|---------------------------------|--------------------------------------|
| Max RF Input | 25 mV | 0.11 V |
| Max RF Input | 25 mV | 0.11 V |
| Max RF Input | 25 mV | 0.11 V |
| Max RF Input | 25 mV | 0.11 V |
| Max RF Input | 25 mV | 0.11 V |

NOTES:
1. All voltages referenced to chassis ground.
DC Supply Voltage = 13.8 V dc
All voltages measured with Motorola Model S1052B DC Multimeter using the SLN6055A RF Probe.
Multiply all voltages by 2 when preamplifier is used.

EPS-4795-O

| METERING POINT | RF VOLTAGE AT ANTENNA CONNECTOR | NOMINAL RF VOLTAGE AT METERING POINT |
|----------------------------------|---------------------------------|--------------------------------------|
| 1st 455 kHz IF Amp. Base (Q301) | 2 mV | 0.11 V |
| 1st 455 kHz IF Amp. Coll. (Q301) | 1 mV | 2.5 V |

NOTES:
1. All voltages referenced to chassis ground.
2. Supply Voltage = 13.8 V dc
3. All voltages measured with Motorola Solid-State dc multimeter with rf probe.

EPS-4796-O

| METERING POINT | NOMINAL VOLTAGES (rms) |
|---|------------------------|
| Base of 1st 455 kHz Limiter (Q304) | 1.1 V |
| Base of 2nd 455 kHz Limiter (Q305) | 1.35 V |
| Base of 3rd 455 kHz Limiter (Q306) | 1.2 V |
| Collector of 3rd 455 kHz Limiter (Q306) | 4.8 V |

NOTES:
1. All voltages measured with Motorola Model S1052B DC Multimeter using the SLN6055A RF Probe.
2. All voltages referenced to chassis ground.

EPS-4797-O

| CIRCUIT METERED | TYPICAL READING |
|---|-----------------|
| Discriminator Output (Collector of Q308) | 1.5 V rms |
| Emitter Follower Output (Emitter of Q309) | 0.53 V rms |
| Base of 1st Audio Amplifier (Q340) | 9 mV rms |
| Collector of 1st Audio Amplifier (Q340) | 0.25 V rms |
| Base of Audio Driver (Q341) | 80 mV |
| Base of Audio Driver (Q342) | 40 mV |
| Collectors of Audio Drivers (Q341, Q342) | 2.7 V rms |
| Bases of Audio Finals (Q343, Q344) | 0.50 V rms |
| Collectors of Audio Finals (Q343, Q344) | 6.6 V rms |
| Audio output into 3.2 Speaker | 3.7 V rms |

NOTES:
1. All readings referenced to chassis.
2. All voltages measured with Motorola Model S1053C AC Voltmeter.
3. VOLUME control at maximum full clockwise; SQUELCH control fully counterclockwise; PL switch OFF.
4. DC Supply Voltage = 13.8 V dc.

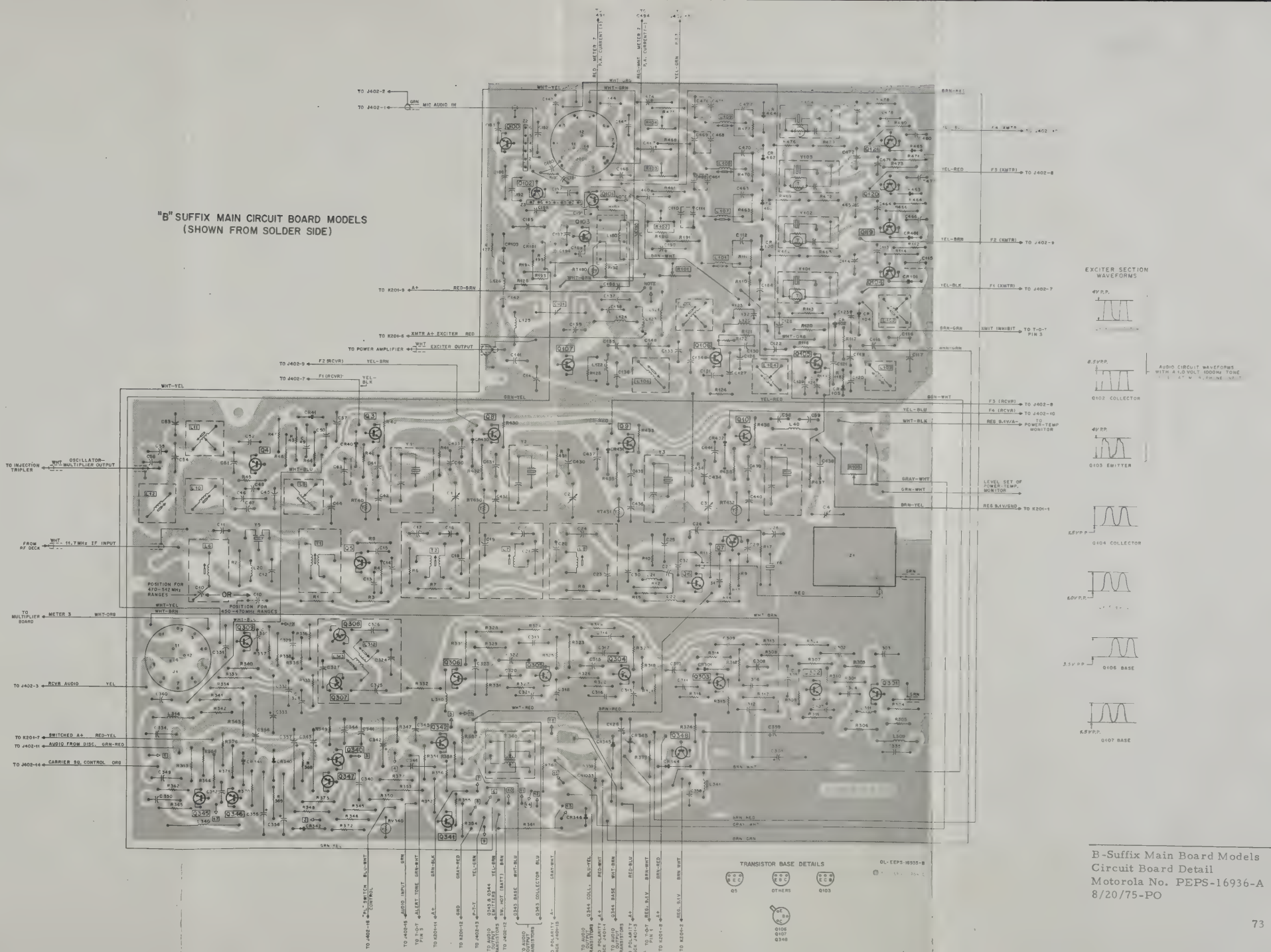
EPS-4798-O

| CIRCUIT METERED | TYPICAL READING |
|-----------------------------------|-----------------|
| Squelch Limiter, Base (Q345) | 0.32 V rms |
| Squelch Limiter, Collector (Q345) | 1.5 V rms |
| Squelch Detectors, Base (Q346) | 0.40 V rms |
| Squelch Detector, Emitter (Q346) | 0.20 V rms |

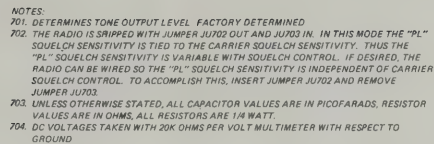
NOTES:
1. All voltages measured with Motorola AC Voltmeter and are referenced to chassis.
2. SQUELCH control at maximum, no signal input.

EPS-4799-O


"B" SUFFIX MAIN CIRCUIT BOARD MODELS
(SHOWN FROM SOLDER SIDE)





B-Suffix Main Board Models
Circuit Board Detail
Motorola No. PEPS-16936-A
8/20/75-PO



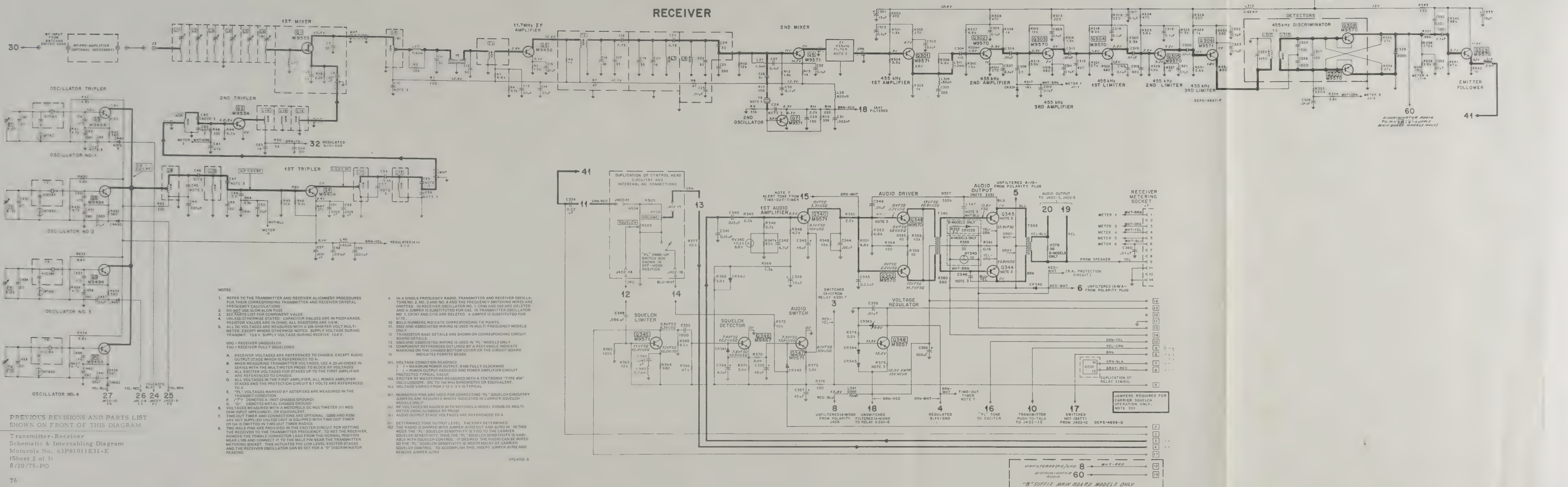
LEGEND

 = THEORY OF OPERATION DATA

 = PRIMARY SIGNAL FLOW

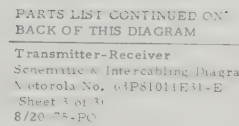
 = SECONDARY SIGNAL FLOW

"Private-Line" Decoder
Schematic Diagram
Motorola No. 63P81011E31-E
(Sheet 1 of 3)
8/20/75-PO

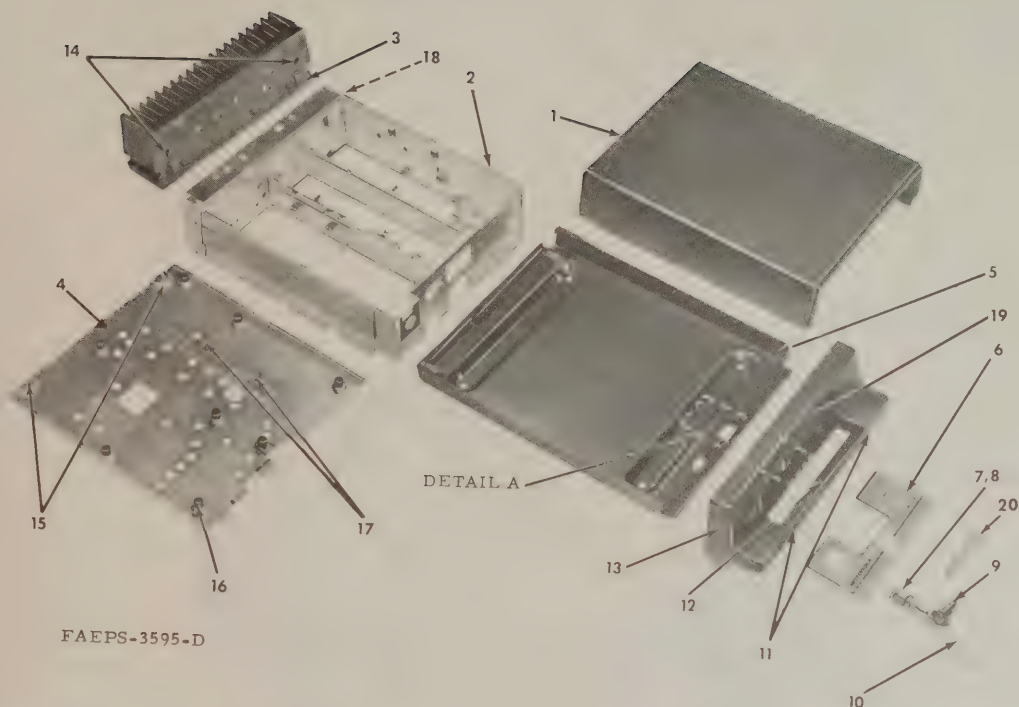


PREVIOUS REVISIONS AND PARTS LIST SHOWN ON FRONT OF THIS DIAGRAM

Transmitter-Receiver
Schematic & Interconnecting Diagram
Motorola No. 63P81011E31-E
(Sheet 2 of 3)
8/20/75-PO



| REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION | REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION | REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION | REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION | REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION | REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION | REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION | REFERENCE SYMBOL | MOTOROLA PART NO. | DESCRIPTION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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---|----------|-----|------|----------|-----|------|----------|-----|------|----------|-----|------|----------|-----|------|----------|-----|------|----------|-----|------|---|
| L650 thru 651 | 76-83960B01 | ferrite bead | R4 | 6-129231 | 3.3k | R328 | 6-127800 | 220 | R678 | 6-131524 | 100 $\pm 5\%$ | RV340 | 6-858401 | VARISTOR: 17.2k ohms $\pm 10\%$; 8.8V @25°C | 7-84691C01 | BRACKET, grounding: for grounding coaxial shields on BUSHING, screw retaining: "snap-in" type; 2 req'd | NOTE The following are electrical components unique to the "A" Suffix Main Circuit Board Models only. | C1+2 | 8-82905G01b | CAPACITOR, film-- 0.05 μ F $\pm 5\%$; 250V | Q108 | 48-869780 | 48-869780 | Q113 | 48-869576 | 48-869576 | Q114 | 48-869570 | 48-869570 | Q115 | 48-869570 | 48-869570 | Q116 | 48-869571 | 48-869571 | Q117 | 48-869570 | 48-869570 | Q118 | 48-869440 | 48-869440 | Q119 thru 121 | 48-869494 | 48-869494 | Q301 | 48-869571 | 48-869571 | Q302 thru 305 | 48-869570 | 48-869570 | Q306 | 48-869571 | 48-869571 | Q307 thru 309 | 48-869570 | 48-869570 | Q340 | 48-869571 | 48-869571 | Q341, 342 | 48-869570 | 48-869570 | Q343, 344 | 48-869872 | 48-869872 | Q345 | 48-869571 | 48-869571 | Q346 | 48-869467 | 48-869467 | Q347 | 48-869571 | 48-869571 | Q348 | 48-869571 | 48-869571 | Q701 | 48-869570 | 48-869570 | Q702 | 48-869571 | 48-869571 | Q703 | 48-869570 | 48-869570 | Q704 | 48-869571 | 48-869571 | Q705 | 48-869571 | 48-869571 | Q706 | 48-869570 | 48-869570 | Q707 | 48-869571 | 48-869571 | Q751 thru 755 | 48-869570 | 48-869570 | Q756 | 48-869571 | 48-869571 | Q757 | 48-869570 | 48-869570 | R1 | 6-129753 | 10k $\pm 5\%$ | R2 | 6-129668 | 10k $\pm 5\%$ | R3 | 6-129687 | 6.8k | R4 | 6-129231 | 3.3k | R5 | 6-127803 | 1k | R6 | 6-129233 | 47 | R7, 8 | 6-127807 | 33k | R9 | 6-129230 | 12k | R10 | 6-129804 | 2.2k | R11 | 6-129236 | 1.8k | R12 | 6-127807 | 33k | R13 | 6-127807 | 33k | R14 | 6-127807 | 33k | R15 | 6-127807 | 33k | R16 | 6-127807 | 33k | R17 | 6-127807 | 33k | R18 | 6-127807 | 33k | R19 | 6-127807 | 33k | R20 | 6-127807 | 33k | R21 | 6-127807 | 33k | R22 | 6-127807 | 33k | R23 | 6-127807 | 33k | R24 | 6-127807 | 33k | R25 | 6-127807 | 33k | R26 | 6-127807 | 33k | R27 | 6-127807 | 33k | R28 | 6-127807 | 33k | R29 | 6-127807 | 33k | R30 | 6-127807 | 33k | R31 | 6-127807 | 33k | R32 | 6-127807 | 33k | R33 | 6-127807 | 33k | R34 | 6-127807 | 33k | R35 | 6-127807 | 33k | R36 | 6-127807 | 33k | R37 | 6-127807 | 33k | R38 | 6-127807 | 33k | R39 | 6-127807 | 33k | R40 | 6-127807 | 33k | R41 | 6-127807 | 33k | R42 | 6-127807 | 33k | R43 | 6-127807 | 33k | R44 | 6-127807 | 33k | R45 | 6-127807 | 33k | R46 | 6-127807 | 33k | R47 | 6-127807 | 33k | R48 | 6-127807 | 33k | R49 | 6-127807 | 33k | R50 | 6-127807 | 33k | R51 | 6-127807 | 33k | R52 | 6-127807 | 33k | R53 | 6-127807 | 33k | R54 | 6-127807 | 33k | R55 | 6-127807 | 33k | R56 | 6-127807 | 33k | R57 | 6-127807 | 33k | R58 | 6-127807 | 33k | R59 | 6-127807 | 33k | R60 | 6-127807 | 33k | R61 | 6-127807 | 33k | R62 | 6-127807 | 33k | R63 | 6-127807 | 33k | R64 | 6-127807 | 33k | R65 | 6-127807 | 33k | R66 | 6-127807 | 33k | R67 | 6-127807 | 33k | R68 | 6-127807 | 33k | R69 | 6-127807 | 33k | R70 | 6-127807 | 33k | R71 | 6-127807 | 33k | R72 | 6-127807 | 33k | R73 | 6-127807 | 33k | R74 | 6-127807 | 33k | R75 | 6-127807 | 33k | R76 | 6-127807 | 33k | R77 | 6-127807 | 33k | R78 | 6-127807 | 33k | R79 | 6-127807 | 33k | R80 | 6-127807 | 33k | R81 | 6-127807 | 33k | R82 | 6-127807 | 33k | R83 | 6-127807 | 33k | R84 | 6-127807 | 33k | R85 | 6-127807 | 33k | R86 | 6-127807 | 33k | R87 | 6-127807 | 33k | R88 | 6-127807 | 33k | R89 | 6-127807 | 33k | R90 | 6-127807 | 33k | R91 | 6-127807 | 33k | R92 | 6-127807 | 33k | R93 | 6-127807 | 33k | R94 | 6-127807 | 33k | R95 | 6-127807 | 33k | R96 | 6-127807 | 33k | R97 | 6-127807 | 33k | R98 | 6-127807 | 33k | R99 | 6-127807 | 33k | R100 | 6-127807 | 33k | R101 | 6-127807 | 33k | R102 | 6-127807 | 33k | R103 | 6-127807 | 33k | R104 | 6-127807 | 33k | R105 | 6-127807 | 33k | R106 | 6-127807 | 33k | R107 | 6-127807 | 33k | R108 | 6-127807 | 33k | R109 | 6-127807 | 33k | R110 | 6-127807 | 33k | R111 | 6-127807 | 33k | R112 | 6-127807 | 33k | R113 | 6-127807 | 33k | R114 | 6-127807 | 33k | R115 | 6-127807 | 33k | R116 | 6-127807 | 33k | R117 | 6-127807 | 33k | R118 | 6-127807 | 33k | R119 | 6-127807 | 33k | R120 | 6-127807 | 33k | R121 | 6-127807 | 33k | R122 | 6-127807 | 33k | R123 | 6-127807 | 33k | R124 | 6-127807 | 33k | R125 | 6-127807 | 33k | R126 | 6-127807 | 33k | R127 | 6-127807 | 33k | R128 | 6-127807 | 33k | R129 | 6-127807 | 33k | R130 | 6-127807 | 33k | R131 | 6-127807 | 33k | R132 | 6-127807 | 33k | R133 | 6-127807 | 33k | R134 | 6-127807 | 33k | R135 | 6-127807 | 33k | R136 | 6-127807 | 33k | R137 | 6-127807 | 33k | R138 | 6-127807 | 33k | R139 | 6-127807 | 33k | R140 | 6-127807 | 33k | R141 | 6-127807 | 33k | R142 | 6-127807 | 33k | R143 | 6-127807 | 33k | R144 | 6-127807 | 33k | R145 | 6-127807 | 33k | R146 | 6-127807 | 33k | R147 | 6-127807 | 33k | R148 | 6-127807 | 33k | R149 | 6-127807 | 33k | R150 | 6-127807 | 33k | R151 | 6-127807 | 33k | R152 | 6-127807 | 33k | R153 | 6-127807 | 33k | R154 | 6-127807 | 33k | R155 | 6-127807 | 33k | R156 | 6-127807 | 33k | R157 | 6-127807 | 33k | R158 | 6-127807 | 33k | R159 | 6-127807 | 33k | R160 | 6-127807 | 33k | R161 | 6-127807 | 33k | R162 | 6-127807 | 33k | R163 | 6-127807 | 33k | R164 | 6-127807 | 33k | R165 | 6-127807 | 33k | R166 | 6-127807 | 33k | R167 | 6-127807 | 33k | R168 | 6-127807 | 33k | R169 | 6-127807 | 33k | R170 | 6-127807 | 33k | R171 | 6-127807 | 33k | R172 | 6-127807 | 33k | R173 | 6-127807 | 33k | R174 | 6-127807 | 33k | R175 | 6-127807 | 33k | R176 | 6-127807 | 33k | R177 | 6-127807 | 33k | R178 | 6-127807 | 33k | R179 | 6-127807 | 33k | R180 | 6-127807 | 33k | R181 | 6-127807 | 33k | R182 | 6-127807 | 33k | R183 | 6-127807 | 33k | R184 | 6-127807 | 33k | R185 | 6-127807 | 33k | R186 | 6-127807 | 33k | R187 | 6-127807 | 33k | R188 | 6-127807 | 33k | R189 | 6-127807 | 33k | R190 | 6-127807 | 33k | R191 | 6-127807 | 33k | R192 | 6-127807 | 33k | R193 | 6-127807 | 33k | R194 | 6-127807 | 33k | R195 | 6-127807 | 33k | R196 | 6-127807 | 33k | R197 | 6-127807 | 33k | R198 | 6-127807 | 33k | R199 | 6-127807 | 33k | R200 | 6-127807 | 33k | R201 | 6-127807 | 33k | R202 | 6-127807 | 33k | R203 | 6-127807 | 33k | R204 | 6-127807 | 33k | R205 | 6-127807 | 33k | R206 | 6-127807 | 33k | R207 | 6-127807 | 33k | R208 | 6-127807 | 33k | R209 | 6-127807 | 33k | R210 | 6-127807 | 33k | R211 | 6-127807 | 33k | R212 | 6-127807 | 33k | R213 | 6-127807 | 33k | R214 | 6-127807 | 33k | R215 | 6-127807 | 33k | R216 | 6-127807 | 33k | R217 | 6-127807 | 33k | R218 | 6-127807 | 33k | R219 | 6-127807 | 33k | R220 | 6-127807 | 33k | R221 | 6-127807 | 33k | R222 | 6-127807 | 33k | R223 | 6-127807 | 33k | R224 | 6-127807 | 33k | R225 | 6-127807 | 33k | R226 | 6-127807 | 33k | R227 | 6-127807 | 33k | R228 | 6-127807 | 33k | R229 | 6-127807 | 33k | R230 | 6-127807 | 33k | R231 | 6-127807 | 33k | R232 | 6-127807 | 33k | R233 | 6-127807 | 33k | R234 | 6-127807 | 33k | R235 | 6-127807 | 33k | R236 | 6-127807 | 33k | R237 | 6-127807 | 33k | R238 | 6-127807 | 33k | R239 | 6-127807 | 33k | R240 | 6-127807 | 33k | R241 | 6-127807 | 33k | R242 | 6-127807 | 33k | R243 | 6-127807 | 33k | R244 | 6-127807 | 33k | R245 | 6-127807 | 33k | R246 | 6-127807 | 33k | R247 | 6-127807 | 33k | R248 | 6-127807 | 33k | R249 | 6-127807 | 33k | R250 | 6-127807 | 33k | R251 | 6-127807 | 33k | R252 | 6-127807 | 33k | R253 | 6-127807 | 33k | R254 | 6-127807 | 33k | R255 | 6-127807 | 33k | R256 | 6-127807 | 33k | R257 | 6-127807 | 33k | R258 | 6-127807 | 33k | R259 | 6-127807 | 33k | R260 | 6-127807 | 33k | R261 | 6-127807 | 33k | R262 | 6-127807 | 33k | R263 | 6-127807 | 33k | R264 | 6-127807 | 33k | R265 | 6-127807 | 33k | R266 | 6-127807 | 33k | R267 | 6-127807 | 33k | R268 | 6-127807 | 33k | R269 | 6-127807 | 33k | R270 | 6-127807 | 33k | R271 | 6-127807 | 33k | R272 | 6-127807 | 33k | R273 | 6-127807 | 33k | R274 | 6-127807 | 33k | R275 | 6-127807 | 33k | R276 | 6-127807 | 33k | R277 | 6-127807 | 33k | R278 | 6-127807 | 33k | R279 | 6-127807 | 33k | R280 | 6-127807 | 33k | R281 | 6-127807 | 33k | R282 | 6-127807 | 33k | R283 | 6-127807 | 33k | R284 | 6-127807 | 33k | R285 | 6-127807 | 33k | R286 | 6-127807 | 33k | R287 | 6-127807 | 33k | R288 | 6-127807 | 33k | R289 | 6-127807 | 33k | R290 | 6-127807 | 33k | R291 | 6-127807 | 33k | R292 | 6-127807 | 33k | R293 | 6-127807 | 33k | R294 | 6-127807 | 33k | R295 | 6-127807 | 33k | R296 | 6-127807 | 33k | R297 | 6-127807 | 33k | R298 | 6-127807 | 33k | R299 | 6-127807 | 33k | R300 | 6-127807 | 33k | R301 | 6-127807 | 33k | R302 | 6-127807 | 33k | R303 | 6-127807 | 33k | R304 | 6-127807 | 33k | R305 | 6-127807 | 33k | R306 | 6-127807 | 33k | R307 | 6-127807 | 33k | R308 | 6-127807 | 33k | R309 | 6-127807 | 33k | R310 | 6-127807 | 33k | R311 | 6-127807 | 33k | R312 | 6-127807 | 33k | R313 | 6-127807 | 33k | R314 | 6-127807 | 33k | R315 | 6-127807 | 33k | R316 | 6-127807 | 33k | R317 | 6-127807 | 33k | R318 | 6-127807 | 33k | R319 | 6-127807 | 33k | R320 | 6-127807 | 33k | R321 | 6-127807 | 33k | R322 | 6-127807 | 33k | R323 | 6-127807 | 33k | R324 | 6-127807 | 33k | R325 | 6-127807 | 33k | R326 | 6-127807 | 33k | R327 | 6-127807 | 33k | R328 | 6-127807 | 33k | R329 | 6-127807 | 33k | R330 | 6-127807 | 33k | R331 | 6-127807 | 33k | R332 | 6-127807 | 33k | R333 | 6-127807 | 33k | R334 | 6-127807 | 33k | R335 | 6-127807 | 33k | R336 | 6-127807 | 33k | R337 | 6-127807 | 33k | R338 | 6-127807 | 33k | R339 | 6-127807 | 33k | R340 | 6-127807 | 33k | R341 | 6-127807 | 33k | R342 | 6-127807 | 33k | R343 | 6-127807 | 33k | R344 | 6-127807 | 33k | R345 | 6-127807 | 33k | R346 | 6-127807 | 33k | R347 | 6-127807 | 33k | R348 | 6-127807 | 33k | R349 | 6-127807 | 33k | R350 | 6-127807 | 33k | R351 | 6-127807 | 33k | R352 | 6-127807 | 33k | R353 | 6-127807 | 33k | R354 | 6-127807 | 33k | R355 | 6-127807 | 33k | R356 | 6-127807 | 33k | R357 | 6-127807 | 33k | R358 | 6-127807 | 33k | R359 | 6-127807 | 33k | R360 | 6-127807 | 33k | R361 | 6-127807 | 33k | R362 | 6-127807 | 33k | R363 | 6-127807 | 33k | R364 | 6-127807 | 33k | R365 | 6-127807 | 33k | R366 | 6-127807 | 33k | R367 | 6-127807 | 33k | R368 | 6-127807 | 33k | R369 | 6-127807 | 33k | R370 | 6-127807 | 33k | R371 | 6-127807 | 33k | R372 | 6-127807 | 33k | R373 | 6-127807 | 33k | R374 | 6-127807 | 33k | R375 | 6 |



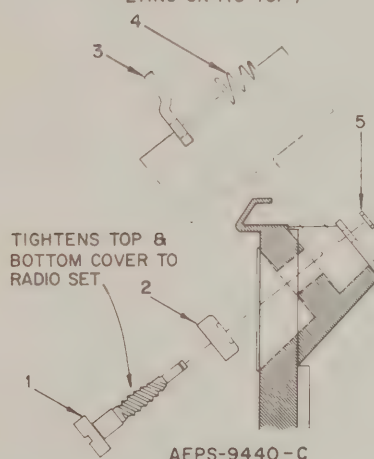
PARTS LIST

PL-1184-D

| CODE | MOTOROLA PART NO. | DESCRIPTION |
|------|----------------------|--|
| 1 | 15E84920A03 | COVER, housing; top |
| 2 | 27E84441C03 | CHASSIS |
| 3 | 26D84020B01 | RADIATOR, heatsink (450-470 MHz) |
| | or 1V80740B41 | RADIATOR, heatsink (470-512 MHz) |
| 4 | 15C84491B01 | COVER, bottom |
| 5 | 15E84920A01 | HOUSING, base |
| 6 | 13C84921A02 | ESCUTCHEON |
| 7 | 55-84912A03 | LOCK ASSEMBLY (complete) |
| 8 | 55-84912A01 | BARREL AND NUT (P/O code 7) |
| 8A | 55-84912A02 | CYLINDER AND KEY (P/O code 7) |
| | | NOTE: Code 8A (Cylinder and Key) must be removed using code item 10 (TOOL, lock-cylinder removal) before the front panel can be removed. |
| 9 | 55-893872 | KEY (P/O code 7) |
| 10 | 66A84909B01 | TOOL, for removal of lock |
| 11 | 3S125457 | SCREW, special; for handle |
| 12 | 55C84909A01 | HANDLE |
| 13 | 1V80708B66 | FRONT PANEL, does not incl. code 7, 11, 12 |
| 14 | 3S135031 | SCREW, special |
| | 42A82234G01 | RETAINER |
| | 4S115362 | LOCKWASHER |
| 15 | 3B84048B01 | SCREW, special |
| | 42A82388C02 | RETAINER |
| | 4S115362 | LOCKWASHER |
| 16 | 75A84962A01 | BUMPER, rubber |
| 17 | 43B82721C03 | BUSHING, snap |
| | 3S135111 | SCREW, tapping: No. 4-40 x 3/8" |
| 18 | 14C84656C01 | RETAINER, tuning tool |
| 19 | 3-138806 | SCREW, machine: 8-32 x 5/16" |
| 20 | 55-84530B01 | BOLT, locking (nylon) |

DETAIL A

(VIEWED WITH RADIO SET
LYING ON ITS TOP)



| CODE | MOTOROLA PART NO. | DESCRIPTION |
|--------------------------|----------------------|----------------------------|
| Front Panel Latching Kit | | |
| PL-1943-O | | |
| *1 | 3B84460G01 | SCREW, latching |
| 2 | 4A84362B01 | WASHER, cup |
| *3 | 45B84461G01 | CAM, latching |
| 4 | 41A822468 | SPRING, Locking plate |
| 5 | 42A82388C03 | RING, retaining ("E" type) |

* Codes 1 & 3 must be replaced together

450-470 MHz and 470-512 MHz "Mocom-70"

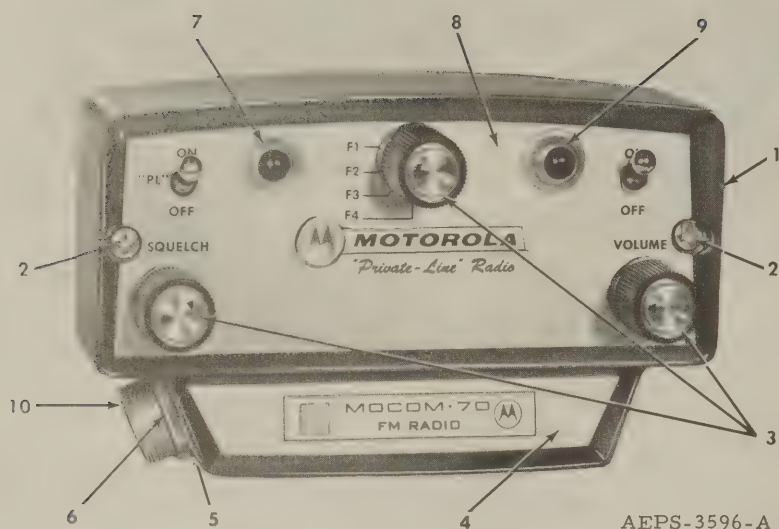
FM Radio

Heat Sink and Housing Detail

Universal Model Radio Set

Motorola No. PEPS-4865-E

8/20/75-PO



AEPS-3596-A

PARTS LIST

PL-931-O

| CODE | MOTOROLA PART NO. | DESCRIPTION |
|------|----------------------|--|
| 1 | 15D83576D07 | HOUSING, dash-mount |
| | or 15D83576D03 | HOUSING, trunk-mount |
| 2 | 3A82670A07 | SCREW, special: dash-mount |
| | or 3A82670A01 | SCREW, special: trunk-mount |
| 3 | 36B82629H02 | KNOB, control; dash-mount |
| | or 36K858652 | KNOB, control; trunk-mount |
| 4 | 33B83646D07 | NAMEPLATE (dimmer) |
| | or 33C83646D08 | NAMEPLATE (non-dimmer) |
| 5 | 4S7699 | WASHER, lock; 13/16" INT. |
| 6 | 2A482070 | NUT, ring |
| 7 | 61B83678D01 | LENS, indicator light (RED) |
| | 13D857971 | ESCUTCHEON, 1 freq. (carrier squelch) |
| | or 13K857972 | ESCUTCHEON, 2 freq. (carrier squelch) |
| | or 13D82286C23 | ESCUTCHEON, 4 freq. (carrier squelch) |
| | or 13K857975 | ESCUTCHEON, 1 freq. ("Private-Line") |
| | or 13K857976 | ESCUTCHEON, 2 freq. ("Private-Line") |
| | or 13D82286C22 | ESCUTCHEON, 4 freq. ("Private-Line") |
| 9 | 61B83678D02 | LENS, indicator light (GREEN) |
| 10 | 9K830418 | CONNECTOR, receptacle; female: 4 contact |

Control Head Escutcheon and
Housing Detail
Motorola No. PEPS-3599-B
8/20/75-PO

REDUCTION OF INTERFERING NOISE IN MOBILE OPERATION

1. INTRODUCTION

Noise generated by the electrical system of the vehicle, as well as local ambient noise, might interfere with normal operation of two-way mobile radios. To overcome these interferences, various noise reduction procedures are required. These requirements vary from one vehicle to another, depending on system frequency, vehicle type and required coverage area. If the operating area is sufficiently small (received signal levels always high), less noise reduction is required. Conversely, for maximum range coverage and operation into weak signal areas, noise reduction becomes very important.

Before attempting any noise reduction procedures, determine the noise source. Then, follow a systematic method of elimination until

the interference is removed or appreciably reduced.

2. NOISE REDUCTION

a. Noise Reduction Kits

The Model TLN8845A Noise Reduction Kit is available for all vehicles equipped with two-way radios. For vehicles with generators or with severe noise problems, Model TLN6252A Noise Reduction Kit is recommended. See Figures 1 and 2.

b. General Information

Impulse noise is most noticeable in installations of narrow bandwidth receivers because of ringing associated with the steep-sided selectivity characteristics. This equipment has been designed to minimize the ringing effect of impulse noise as much as possible.



MOTOROLA INC.

Communications Division

ENGINEERING PUBLICATIONS

1301 E. ALGONQUIN ROAD

SCHAUMBURG, ILLINOIS 60172

TLN6252A NOISE REDUCTION KIT

| Reference Number | Quantity | Motorola Part Number | Description |
|------------------|----------|----------------------|---------------------------------------|
| 1 | 3 | 1V839913 | Lead & Lug Assembly |
| 2 | 1 | 1V80700A88 | Lead & Lug Assembly |
| 3 | 1 | 8C82571B02 | Capacitor, Coaxial (.1 uF - 100 V) |
| 4 | 3 | 8C82571B01 | Capacitor, Coaxial (.5 uF - 100 V) |
| 5 | 1 | 1V80700A89 | Generator Field Suppressor Assembly |
| 6 | 1 | 30A502396 | Ignition Coil Suppressor Cable |
| 7 | | 1V80700A91 | Hood Wipers and Mounting Kit Hardware |

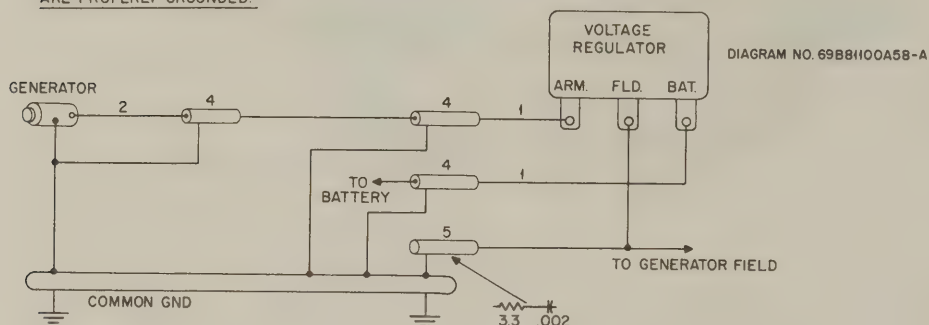
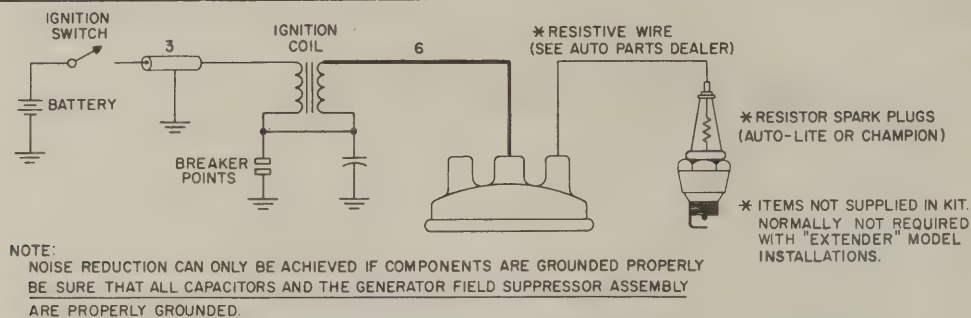


Figure 1. Typical Noise Reduction Detail Using TLN6252A Noise Reduction Kit

TLN8845A NOISE REDUCTION KIT

| Quantity | Motorola Part Number | Description |
|----------|----------------------|---------------------------------------|
| 1 | 1V839913 | Lead & Lug Assembly |
| 1 | 8C82571B02 | Capacitor, Coaxial (.1 uF, 100 V) |
| 1 | 30A502396 | Ignition Coil Suppressor Cable |
| 1 | 1V80782A52 | Hood Wipers and Mounting Hardware Kit |

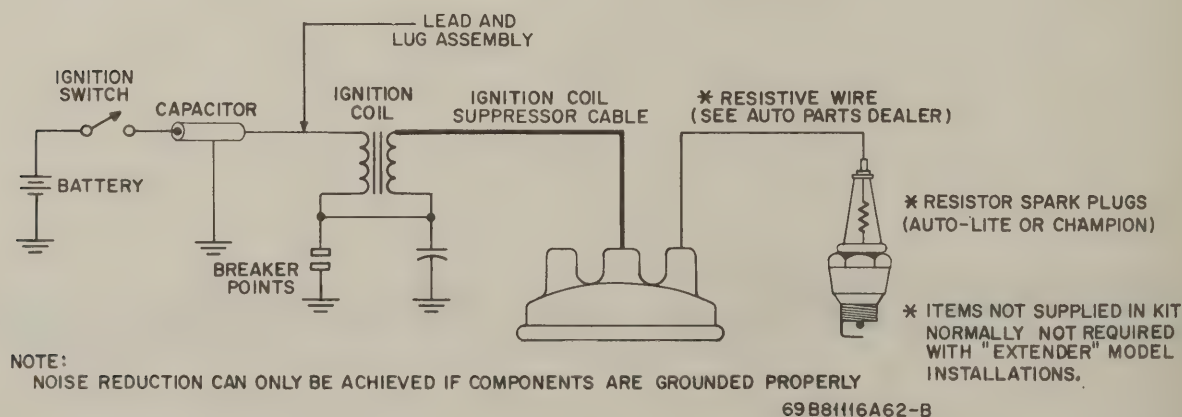


Figure 2. Typical Noise Reduction Detail Using TLN8845A Noise Reduction Kit

The useful range of radio receivers can be seriously affected by noise interference which prevents the reception of a clear, easily-understandable signal. A certain amount of noise interference may be tolerated when operating in a strong signal area. However, in weak signal areas such as fringe area operation, serious noise interference can cause a complete failure in reception.

c. Noise Sources

The source of noise can generally be determined by its sound in the speaker. For best results in locating noise, the unit should be receiving a weak signal which produces not less than 10 dB nor more than 30 dB noise quieting.

Noise interference is usually traced to one of the following sources:

(1) Ignition Noise

An automobile electrical system provides the primary source of electrical interference to radio communications in mobile installations. Radio interference can be generated in the spark plugs, distributor contacts, generator armature, voltage regulator, electrical gauges, wheel static and any part of the car where friction may exist due to intermittent contact between any two members of the car's mechanical structure.

In a mobile installation, the prime source of electrical interference with radio communications is in most cases the result of a spark discharge or arc created in the electrical system. Whenever a spark discharge takes place through air, high frequency oscillations are generated in a range of frequencies from a few kilohertz to hundreds of megahertz. These oscillations are generally radiated and therefore received through the antenna. However, they may also be induced in associated wiring and transferred to other electrical wiring in the system including that of the radio installation.

Suppressing all arcing that can develop in the electrical system may pose a difficult problem. For example, in an 8 cylinder engine operated at 2000 RPM, arcing in the engine system can be at the rate of 8,000 sparks per minute or 133 per second. These arcs, after being extended because of ringing, can create a blanket of noise which will block out weak signals at the radio receiver.

(2) Impulse noise interference generated by the vehicle electrical system.

This type of interference is generated by commutator and brush action, vibration of electrical contacts and electrical arcing or sparking. This broad-band interference may be propagated via space radiation.

The impulse noise enters the receiver through the antenna and serious interference in the form of tuned circuit "ringing" results even though the impulse may be very brief. "Ringing" may be defined as the shock excitation of a tuned circuit caused by an impulse which extends the duration of the impulse. It is the "ringing", caused by the impulse rather than the impulse itself, which is troublesome.

(3) Noise produced by fluorescent lights, electric motors, electric fences, induction from power lines and similar sources.

This type of interference is generally AM in nature, excluding capture effect. Normally, if signal strength is adequate, all such noise is removed from a received carrier by effective limiting action. Also, a vehicle is able to move out of a high noise level area if this type of noise interferes with radio reception. Thus, such conditions may be tolerated.

NOTE

Thermal agitation noise and noise produced in the receiver have been taken into consideration in the original design of the equipment. Any well designed mobile radio unit will not present any serious problems in this respect.

d. The Ignition System

In order to effectively reduce ignition interference in a car, it is well to understand the operation of an automobile ignition system.

Ignition is necessary in a gasoline engine to ignite the gasoline vapor and the air mixture in its cylinders. The system is made up of the battery, distributor, breaker points, coil, condenser and spark plugs. The battery is the only electrical source of power in an automobile, so the low battery voltage must be stepped up to the high voltage necessary to arc across the spark plug electrodes. This arc ignites the gas mixture.

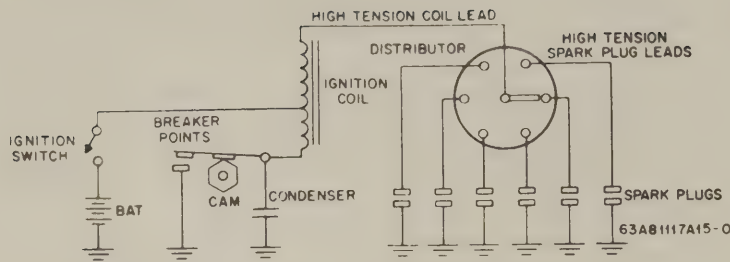


Figure 3.

Typical Vehicular Ignition System, Schematic Diagram

In the conventional ignition system (Figures 3 and 4) a mechanical circuit breaker (points in the distributor) opens the primary circuit of the ignition coil. By transformer action in the coil, high voltage is developed at the coil secondary. This high voltage is synchronized and applied to each spark plug by the distributor.

The battery is connected to the primary winding of the coil through the ignition switch. The primary circuit is returned to the battery through the breaker points, which are bypassed by the condenser. The points are normally closed. As the cam shaft is rotated by the engine, its lobes or corners open and close the points in proper synchronization with each cylinder.

With the ignition switch on and the breaker points closed, coil primary current builds up at a rate determined by coil inductance.

When the breaker points open, primary current decreases and by self-induction, an EMF is induced in the primary which is many times greater than the battery voltage. The high voltage induced in the coil secondary causes a spark across the spark plug gap for a short interval of time. When the breaker points open, the condenser reduces arcing of the points.

The secondary circuit of the ignition coil, including the spark gap, is much like a spark transmitter used in the early days of radio. It is the main source of ignition interference. All that is needed to simulate the spark transmitter is an inductance and capacitance in series with the spark gap. The lead inductance and stray

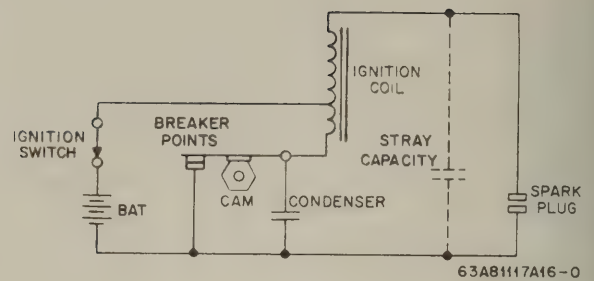


Figure 4.

Typical Vehicular Ignition System, Simplified Schematic Diagram

capacitance provides a tuned circuit. Because the discharge of the circuit is through a low resistance (ionized spark gap), the circuit tends to oscillate. The frequency and amplitude of oscillation that is developed vary as current changes in the spark gap.

e. Noise Reduction Technique

It has long been known by ignition engineers that the addition of a series resistance adjacent to a spark discharge will damp out the troublesome oscillation which causes interference. The type of spark plug suppression used in noise reduction should always be in accordance with the recommendations of the car manufacturer, i. e., if spark plugs are to be replaced with built-in suppressor types, they should be in the proper heat ranges and thread sizes for the particular engine. In each ignition system there is a maximum amount of resistance that may be connected between the distributor and a spark plug. If resistance-type ignition wire is used, the length of each wire must be limited so its resistance does not exceed the allowable maximum. In addition to spark plug suppressors or resistance wire, an economical basic kit of noise reduction items can consist of the following: special coaxial capacitors, combinations of resistor and capacitor assemblies and hood wiper springs.

NOTE

In all cases where coaxial capacitors are mentioned, they should not be substituted by standard bypass capacitors; the standard bypass displays a resonance effect at about 2 MHz. The coaxial type is non-inductive and has high attenuation, up into the uhf region.

The importance of such noise reduction items is greatly increased by their application at the right terminal points in the car's electrical system. Following is an outline of the important points to be considered and a step by step procedure for ignition noise reduction.

NOTE

Noise reduction can only be achieved if components are properly grounded. BE SURE THAT ALL CAPACITORS AND THE GENERATOR FIELD SUPPRESSOR ASSEMBLY ARE PROPERLY GROUNDED.

On some vehicles, standard bypass capacitors might have been installed at locations referred to in these instructions. Where the instructions call for coaxial capacitors, remove the standard bypass capacitor and install the coaxial type.

In the development of a noise reduction kit, it was not necessary to include resistance cable or suppressor resistors in the wiring harness. Such items are generally found as a standard part of present day motor vehicles. However, the omission of such items from a basic noise kit does not imply that these items are nonessential to noise reduction. Spark plug noise reduction is one of the most important points to be covered in the elimination of radio interference in any vehicle.

(1) Generator Interference (Generator Equipped Vehicles Only)

The generator is a source of electrical interference frequently blamed on the ignition system. Electrical current passing between the brushes and commutator in the generator creates many small arcs as the armature rotates. Generator noise is characterized by a high pitched "whine" that varies with engine speed. A .5 uF coaxial capacitor should be placed in series with the generator armature to reduce interference.

NOTE

If the vehicle is supplied with an alternator, the capacitor is not necessary.

(2) Voltage Regulator Interference

The modern voltage regulator is a precise mechanism containing three separate control systems operating with breaker contacts. Vibrating breaker contacts cause arcing which

may result in annoying interference. This interference is usually in the form of erratic popping in the receiver which changes only slightly in frequency with increase in engine speed.

To reduce voltage regulator noise, two .5 uF coaxial capacitors and a resistor-capacitor assembly are used.

CAUTION

Disconnect the battery ground terminal before attempting to connect components to the battery terminal of the voltage regulator.

(3) Ignition Coil Interference

A .1 uF coaxial capacitor should be placed at the BAT side of the ignition coil to eliminate impulses from the low voltage leads. (Refer to Figures 1 and 2.)

(4) Distributor Interference

Sparking in the distributor itself is a source of radio interference. As the rotor rotates in the cap, sparking occurs between the rotor and the distributor cap inserts. An effective way to reduce this interference is to use resistance-type ignition wire to connect the distributor cap to the ignition coil.

(5) Battery Connection

Connecting the radio set primary power lead directly to the battery instead of the starter relay can help to keep noise off the "A" lead. The battery acts as a large capacitor (about 1 farad for 50 amp capacity batteries), and serves as a very effective bypass. The battery ground return should be bonded to the frame. To minimize the possibility of inducing undesirable parallel ground currents, utilize the vehicle frame as a common ground point whenever it is practical to do so.

(6) Hood Wipers

Ground returns for the electrical circuits are provided through the body and frame of the automobile. Differences in conductivity, inadequate bonds between adjacent conductors, and unequal current distributions result in potential differences throughout the vehicle. The miniature arcs thus created can be avoided by eliminating the potential differences. Effective use of copper bonding braid and brass contact wipers as hood bonds will minimize interference from this source.

(7) Ignition System Interference

Ignition Noise can often be reduced by proper engine maintenance and tune-up. The following points should be considered if the noise interference from the ignition system is severe.

(a) The distributor points and condenser should be in good condition.

(b) Ignition timing should be properly adjusted.

(c) The distributor cap and rotor should be replaced at least every 30,000 miles.

(d) Spark plug wires should make good contact at each end and should be routed as far as possible from low voltage leads.

(e) Many late-model automobiles are equipped with a shield over the distributor points. Check to see that this shield is in place properly and is securely attached.

f. Additional Noise Reduction Techniques

In some radio installations, it might be necessary to obtain maximum noise reduction. In such installations, the following possible sources of noise interference should be explored and the following appropriate remedy applied.

(1) Ammeter to battery lead. (Bypass with .5 uF capacitor. Motorola part #8A821889.)

(2) Gauges, oil signal, gasoline and temperature. (Bypass with .5 uF capacitor. Motorola part #8A821889.)

(3) Ignition switch. (Bypass with .5 uF capacitor. Motorola part #8A821889.)

(4) Headlight, tail light, or dome light leads. (Bypass with .5 uF capacitor. Motorola part #8A821889.)

(5) Accessory wiring, electrical windshield wipers, heater motor, window openers and others. (Bypass with .5 uF capacitors. Motorola part #8A821889.)

(6) Wheel static. (Use wheel static collector rings on both front wheels. Motorola part numbers 1K534254 Regular Type; 1K563173 Small Type.)

(7) Acute cases of generator noise. (Install a .5 uF capacitor in series with the armature lead. Motorola part #8A821889.)

(8) For severe cases of ignition interference, Hallett Ignition Shielding Kits are available through Motorola on separate order. These special shielded harnesses, available for most automobile and truck engines, provide improved communication in fringe areas and essentially waterproof the ignition system. Supply the following information when ordering Hallett Ignition Shielding Kits.

(a) Make and year of vehicle.

(b) Auto or truck and number of cylinders.

(c) Engine cubic inch displacement.

(d) Type of ignition system: Auto-Lite, Chrysler, etc.

NOTE

Fire truck engine shielding requires more detailed information to assist in supplying the proper kit. Write first for the special "fire truck shielding form" from your nearest Motorola Parts Depot.

(9) A generator-regulator shield is available to further reduce generator and regulator noise. It is not required on alternator-equipped vehicles. Follow the same ordering procedure when requesting this item.

g. Conclusion

The level to which ignition noise interference will need to be reduced will depend on the environmental conditions of operation of the radio system. The factors involved are the strength of the received carrier at various points within range of the fixed station, and the clarity of signals at the fringe areas. However, in most cases ignition noise interference can be substantially reduced, resulting in excellent performance of the radio equipment under most operating conditions.

The reduction of ignition noise interference, in many cases, is essential to good system performance. Therefore, it must be given full consideration in the initial installation of the radio

equipment. The components required to successfully reduce ignition noise interference may well prove to be a necessary part of the communications system. Indeed, no mobile radio installation is complete until the remedy for bothersome ignition noise interference has been successfully applied.

Certain noise sources may be isolated to some extent, through consideration of conditions. When the vehicle is standing still with the ignition switch off, any noise heard will probably be external to the vehicle. Static discharge noise will be added when the vehicle is moving. If the vehicle is coasting in gear but with the ignition switch off, generator noise, if present, will be added to the others. Noise produced by inadequate bonding will be most noticeable when maximum current is being drawn from the battery, and may be increased when the vehicle is in motion. Care should be used to be sure that noise tests are made both with and without weak signals.

One effective way to find the hottest sources of interference is to use a pickup loop about one inch in diameter, connected to a radio receiver or oscilloscope powered from a source separate from the vehicle ignition system. Use the pickup loop as a search probe. Be sure the loop has sufficient insulation to prevent the input of the test equipment from coming into direct contact with high voltage points in the vehicle ignition system. This pickup loop technique is also a good way to determine the effectiveness of a particular noise reduction method.

It is impossible to give an exact procedure to counteract noise in all cases; too many variables exist. With an understanding of some of the sources of noise, an intelligent approach will often save considerable time. Ignition noise reduction can add to both operational efficiency and operator satisfaction.

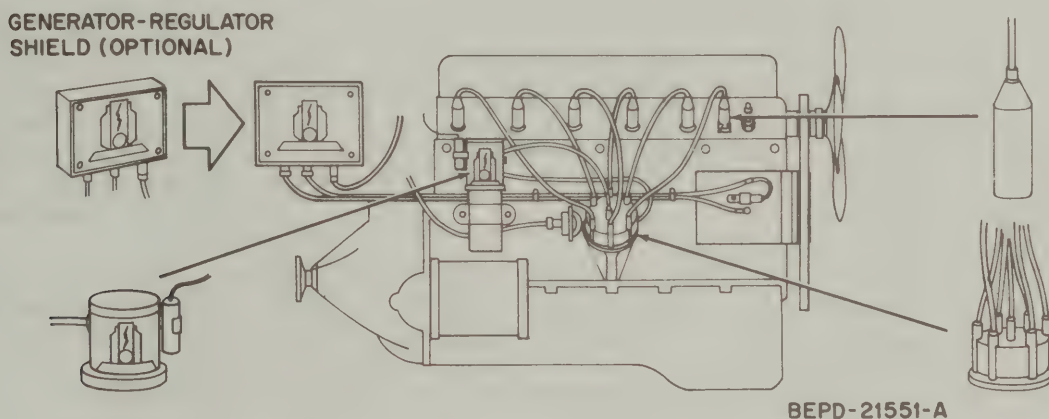


Figure 5. Typical Ignition Shielding Kit

NOISE IDENTIFICATION AND REDUCTION CHART

| Characteristics of Noise at Speaker | Source of Noise | How to Check Source of Noise | How to Reduce Noise |
|-------------------------------------|-----------------------|--|--|
| Identified as popping sound | Ignition | Noise varies in frequency with engine speed and will disappear when ignition is switched off. | <ol style="list-style-type: none"> 1. Check to be sure: <ol style="list-style-type: none"> (a) Distributor breaker points and distributor cap are in good condition. (b) Ignition capacitor is in good condition. (c) All ignition system connections are free of corrosion & making good contact. (d) There is dc continuity in high voltage leads. (e) There are sufficiently high spark plug break-down voltages. (f) Spark plug electrodes are properly spaced and in good condition. 2. Bond each corner of the motor block to chassis ground using a heavy copper grounding braid. 3. Damp the high voltage by installing a resistor suppressor in the distributor rotor lead, or suppressors in the ignition cables or on top of the spark plugs. 4. Install resistor spark plugs or resistance ignition cables. |
| Identified as a high pitched whine | Generator/ Alternator | Noise varies with engine speed and will persist if ignition is switched off while engine is running at a moderate speed. | Install a .5 uF coaxial capacitor at the generator in series with the armature lead. |
| Identified as a raspy sound | Voltage Regulator | Look for arcing voltage regulator contacts | Install .5 uF coaxial capacitors, Motorola Part No. 8A821889 at the battery (BAT.) terminal in series with the battery lead and at the generator (ARM) terminal in series with the armature lead. |

NOISE IDENTIFICATION AND REDUCTION CHART (Cont'd)

| Characteristics of Noise at Speaker | Source of Noise | How to Check Source of Noise | How to Reduce Noise |
|--|--|--|--|
| Identified as raspy sound (continued) | | | Install RC Filter (1V80700A89) composed of a 3.3 Ohm resistor in series with a .002 uF capacitor (Maximum allowable capacity) in series with the field (F) terminal of the voltage regulator to a common ground. |
| Identified as a popping sound | Heater and Air Conditioning Fan Motors | With engine off, turn fan motors on and check for noise. | Install .5 uF coaxial capacitor at the motor in series with the battery lead. |
| Identified as a hissing or crackling sound | Gauges | Noise may be detected by jarring the individual gauges while the ignition is on. | Install .5 uF bypass capacitors where needed. (Motorola part #8A821889) |
| Identified as a low-pitch clicking | Oil Sender | Noise rate varies with oil pressure and stabilizes at point of maximum oil pressure. | Install .5 uF bypass capacitor (Motorola Part #8A821889) from gauge lead terminal on oil sender to chassis ground. |
| Identified as an irregular popping | Wheel Static | Noise disappears when brakes are lightly applied. | Install suitable grounding brushes or springs such as front wheel static eliminators (Motorola Part #1K534254 regular type, 1K563174 small type). |
| Identified as a more regular or sharper popping sound. | Tire Static | Noise becomes much worse at 30-50 mph. | Use anti-static powder in tires with innertube. |

ANTI-SKID BRAKING PRECAUTIONS

1. GENERAL

The following recommended transmitter installation and test procedures are suggested for vehicles with electronic anti-skid braking systems.

2. INSTALLATION SUGGESTIONS

Locate the braking modulator box in the vehicle. The braking modulator box is located in the trunk in Chrysler Corporation cars and either in the trunk or under the dash in General Motors and Ford Corporation automobiles. A service manual may be helpful to aid in the location of the braking modulator box. Perform transmitter installation in accordance with the following recommended procedures:

a. If the braking modulator box is mounted on the right side of the vehicle, mount the transmitter on the left side of the trunk to give it as much space as possible between the braking modulator box and the transmitter. If the braking modulator box is mounted on the left side, reverse the procedure.

b. Use the shortest practical length of Motorola coaxial cable.

c. The antenna should be mounted on the opposite side of the car trunk from the braking modulator box.

d. Route all cables along the center or on the opposite side of the vehicle from the braking modulator box.

e. Do not operate the transmitter while the vehicle is in motion with the trunk lid open.

3. TEST PROCEDURE

This test is divided to cover several different types of interference. Disturbance of the electronic anti-skid device can usually be detected in several different ways concerning the vehicle's braking system, i.e., by the lights, any irregular audible sounds, any change in the performance of the braking system itself, etc.

During checks a. thru f., however, none of the above conditions should be observed if the radio set is properly installed.

a. With car stationary (gear selector in PARK) and the engine running at a fast idle, key (turn the carrier on and off) the transmitter with and without modulation with your foot off of the brake pedal.

b. Repeat the preceding with your foot on the brake pedal.

c. When making this test, while the car is stationary, allow at least 2 car lengths and possibly even more of clear area in front of the vehicle. With your foot on the brake with just enough pressure to keep the vehicle from moving, place the car in a forward gear with the engine at a fast idle, then key the transmitter with and without modulation.

WARNING

Disruption of the anti-skid braking system may cause the vehicle to move forward in addition to the lights and audible sounds mentioned above.

d. Driving at a moderate speed (15-25 mph) with your foot off of the brake pedal, have



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an assistant key the transmitter with and without modulation.

e. Repeat step 4 with foot slightly on the brake pedal to turn on the brake lights.

f. While making a moderate deceleration stop from 25-30 mph, have an assistant key the transmitter with and without modulation.

WARNING

Severe disruption of the electronic anti-skid braking system may cause loss of control of the vehicle during the following test.

g. While making "panic" stops from 20 mph have an assistant key the transmitter with and without modulation.

If no interference or disruption is noticed, repeat by making "panic" stops from 30 mph.

If no malfunctions are observed after the above tests are performed, it can be assumed no apparent problem exists and the car can be released to the customer.

If any of the above tests results in a brake malfunction, contact the car manufacturer service department as soon as possible and remove the radio from the vehicle. Do not complete installation.

MOCOM.70
MOBILE FM Two-Way Radio

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